SECTION I.
BASIC MEASURE INFORMATION

I.A. Measure Name

Overuse of Computed Tomography Scans for the Evaluation of Children with Atraumatic Headache

I.B. Measure Citation Information

Macy ML, Freed GL, Reeves SL, Madden BW, McCormick J, Faasse T, Shevrin CA, Dombkowski KJ for the Quality Measurement Evaluation, Testing, Review, and Implementation Consortium. Overuse of computed tomography scans for the evaluation of children with atraumatic headache. Submitted May 16, 2016 to the National Quality Measures Clearinghouse, Rockville (MD): Agency for Healthcare Research and Quality (AHRQ). Published July 15, 2016.

I.C. Measure Description

Please provide a non-technical description of the measure that conveys to a broad audience what it measures.

This measure assesses the number of computed tomography (CT) scans obtained without indication on or within 30 days after the date of evaluation for atraumatic headache among children, ages 4 through 17 years old. For the purposes of this measure, indications for CT imaging include thunderclap headache, vascular disease, infections, lumbar puncture, new neurologic deficit, or signs and symptoms of increased intracranial pressure. A lower percentage indicates better performance, as reflected by avoidance of CT imaging when it is not indicated.

Headaches are common in the pediatric population (Lateef, Merikangas, et al., 2009), and children with headaches are frequently evaluated in emergency departments and primary care settings (DeVries et al., 2013; NHAMCS, 2011). Although most headaches are not symptomatic of underlying disease, the differential diagnosis list for headache is long, with over 300 different types and causes (Evans, 1996). Headaches are divided into two main classifications: primary headaches, such as migraine or tension headaches, and secondary headaches, which include headaches attributed to a separate condition, such as infection, trauma, tumors, or vascular problems (IHS, 2014). For the purposes of this measure, atraumatic headaches are considered to be primary headaches or secondary headaches unrelated to injury.

CT is a radiologic modality used to create images of internal structures in a slice-by-slice manner, using radiation generated from a high-voltage tube. Rationales for obtaining a CT scan to characterize headache include evaluation for suspected arteriovenous malformation or tumor, patient and parental anxiety about the potential for underlying vascular problems or tumor related to severe and/or recurrent head pain, and legal concerns for a missed diagnosis on the part of health care providers.

CT scans are simple to order because the technology is readily available (Ginde et al., 2008) and image acquisition is fast. However, CT imaging for children with a headache who lack any indication

of trauma, intracranial hemorrhage, or other time-sensitive conditions yields little information (ACR Expert Panel on Pediatric Imaging, Hayes et al., 2012; Evans, 1996; Lateef et al., 2012; Lateef, Grewal, et al., 2009) and exposes children to unnecessary risk from radiation. And yet, neuroimaging is increasingly used to evaluate children who experience headache (Broder et al., 2007; Graf et al., 2008; Larson et al., 2011). In its guidelines for imaging children with secondary headaches accompanied by neurological signs or symptoms of increased intracranial pressure, the American College of Radiology (ACR) recommends magnetic resonance imaging (MRI); CT is suggested as an alternative in instances where MRI is unavailable or problems with sedation arise (ACR Expert Panel on Pediatric Imaging, Hayes et al., 2012).

This measure is focused on the overuse of CT in the setting of headache, a problem that has gained national attention in recent years (Loder et al., 2013). Overuse has been defined as any patient who undergoes a procedure or test for an inappropriate indication (Lawson et al., 2012). Imaging overuse subjects children to a number of risks (Malviya et al., 2000; Mathews et al., 2013; Pearce et al., 2012; Wachtel et al., 2009). Children who undergo CT scans in early childhood tend to be at greater risk for developing leukemia, primary brain tumors, and other malignancies later in life (Mathews et al., 2013; Pearce et al., 2012). Children are also at risk for complications from sedation or anesthesia, which are often required for longer CT imaging sequences. These complications include compromised airway, hypoxia leading to central nervous system injury, and death. Additionally, CT overuse creates cost burdens for the patient, as well as for payers.

This measure uses administrative claims data and is calculated as the percentage of CT scans obtained without indication on or within 30 days after the date of evaluation for atraumatic headache among children, ages 4 through 17 years old.

I.D. Measure Owner

The Quality Measurement, Evaluation, Testing, Review, and Implementation Consortium (Q-METRIC)

I.E. National Quality Forum (NQF) ID (if applicable)

Not applicable

I.F. Measure Hierarchy

Please use this section to note if the measure is part of a measure hierarchy or is part of a measure group or composite measure. The following definitions are used by AHRQ's National Quality Measures Clearinghouse and are available at http://www.qualitymeasures.ahrq.gov/about/hierarchy.aspx:

I.F.1. Please identify the name of the **collection** of measures to which the measure belongs (if applicable). A Collection is the highest possible level of the measure hierarchy. A Collection may contain one or more Sets, Subsets, Composites, and/or Individual Measures.

This measure is part of the Q-METRIC Overuse of Imaging for the Evaluation of Children with Headache or Seizures measures collection.

I.F.2. Please identify the name of the measure **set** to which the measure belongs (if applicable). A Set is the second level of the hierarchy. A Set may include one or more Subsets, Composites, and/or Individual Measures.

This measure is part of the Q-METRIC Overuse of Imaging for the Evaluation of Children with Headache measures set.

I.F.3. Please identify the name of the **subset** to which the measure belongs (if applicable). A Subset is the third level of the hierarchy. A Subset may include one or more Composites and/or Individual Measures.

Not applicable

I.F.4. Please identify the name of the **composite** measure to which the measure belongs (if applicable). A Composite is a measure with a score that is an aggregate of scores from other measures. A Composite may include one or more other Composites and/or Individual Measures. Composites may comprise component measures that can or cannot be used on their own.

Not applicable

I.G. Numerator Statement

The numerator is the number of CT scans obtained without indication on or within 30 days after the date of evaluation for atraumatic headache among children, ages 4 through 17 years old.

Eligible children must be ages 4 through 17 years old during the measurement year for which CT imaging of the head is obtained and must be continuously enrolled in their insurance plan during both the measurement year and the year prior. Table 1 [=IMG1] lists Current Procedural Terminology (CPT) codes associated with CT imaging of the head. (Note, Tables 1-7 can be found in this document beginning on page 43.) International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes to identify atraumatic headache are shown in Table 2 [=IMG3]. Headache must occur on the day of or up to 30 days prior to imaging. Atraumatic headaches are those not associated with trauma occurring in the 7 days prior to imaging.

I.H. Numerator Exclusions (as appropriate)

The following are excluded from the numerator:

- Exclusions based on ICD-9-CM or CPT codes captured in administrative claims data:
    - New neurologic deficits or signs or symptoms of increased intracranial pressure (Table 3 [=IMGII]) between the date of diagnosis and imaging study
    - Thunderclap headache (Table 2 [=IMG3]) on the day of or within 365 days prior to imaging

- Vascular disease (Table 4 [=IMG8]) on the day of or within 365 days prior to imaging
- Infections that would warrant imaging on the day of or within the 365 days before the atraumatic headache (Table 5 [=IMG4])
- Lumbar puncture (Table 6, [=IMG10]) during the visit (same date/date after) where imaging was obtained

I.I. Denominator Statement

The denominator is the number of CT scans obtained on or within 30 days after the date of evaluation for atraumatic headache among children ages 4 through 17 years of age.

I.J. Denominator Exclusions (as appropriate)

The following are excluded from the denominator:

- Exclusions based on ICD-9-CM or CPT codes captured in administrative claims data:
  - Trauma-related headache or pain (Table 2 [=IMG3]) on the day of or within 7 days prior to imaging
  - Head trauma or suspected abuse/neglect (Table 7 [=IMG9]) or the presence of an E-code in claims data) on the day of or within 7 days prior to imaging
  - Imaging study obtained on the day of or within 180 days following neurosurgical intervention (Table 6 [=IMG10])

I.K. Data Sources

Check all the data sources for which the measure is specified and tested.

Data Source	
1. Administrative Data (e.g., claims data)	**X (Specified and Tested)**
2. Paper Medical Record	**X (Tested)**
3. Survey – Health care professional report	
4. Survey – Parent/caregiver report	
5. Survey – Child report	
6. Electronic Medical Record	**X (Tested)**
7. Other (If other, please list all other data sources in the field below.)	

This measure uses administrative claims data. The conversion to ICD-10-CM codes has been performed an is available in the Appendix.

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SECTION II.
DETAILED MEASURE SPECIFICATIONS

Provide sufficient detail to describe how a measure would be calculated from the recommended data sources, either by uploading a separate document or by providing a link to a URL in the field below. Examples of detailed measure specifications can be found in the CHIPRA Initial Core Set Technical Specifications Manual 2011 published by the Centers for Medicare & Medicaid Services.[1] Although submission of formal programming code or algorithms that demonstrate how a measure would be calculated from a query of an appropriate electronic data source are not requested at this time, the availability of these resources may be a factor in determining whether a measure can be recommended for use.

Please see the specification document, *Q-METRIC Overuse of Imaging Measure 8, Overuse of Computed Tomography Scans for the Evaluation of Children with Atraumatic Headache,* at the end of this document.

[1] Initial Core Set of Children's Health Care Quality Measures: Technical Specifications and Resource Manual for Federal Fiscal Year 2011 Reporting. Available at http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Quality-of-Care/Downloads/InitialCoreSetResourceManual.pdf and http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Quality-of-Care/CHIPRA-Initial-Core-Set-of-Childrens-Health-Care-Quality-Measures.html.

SECTION III.
IMPORTANCE OF THE MEASURE

In the following sections, provide brief descriptions of how the measure meets one or more of the following criteria for measure importance (general importance, importance to Medicaid and/or CHIP, complements or enhances an existing measure). Include references related to specific points made in your narrative (not a free-form listing of citations).

III.A. Evidence for General Importance of the Measure

Provide evidence for all applicable aspects of general importance, including but not limited to the following:

- Addresses a known or suspected quality gap or disparity in quality (e.g., addresses a socioeconomic disparity, a racial/ethnic disparity, a disparity for Children with Special Health Care Needs (CSHCN) and/or a disparity for limited English proficiency (LEP) populations.

- Potential for quality improvement (i.e., there are effective approaches to reducing the quality gap or disparity in quality).

- Prevalence of condition among children under age 21 and/or among pregnant women.

- Severity of condition and burden of condition on children, family, and society (unrelated to cost).

- Fiscal burden of measure focus (e.g., clinical condition) on patients, families, public and private payers, or society more generally, currently and over the life span of the child.

- Association of measure topic with children's future health—for example, a measure addressing childhood obesity may have implications for the subsequent development of cardiovascular diseases.

- The extent to which the measure is applicable to changes across developmental stages (e.g., infancy, early childhood, middle childhood, adolescence, young adulthood).

Headache Prevalence and Incidence

Headaches are common in the pediatric population (Lateef et al., 2009), and children with headaches are frequently evaluated in emergency departments and primary care settings (DeVries et al., 2013; NHAMCS, 2011). Headaches occur more often as children grow older (ACR Expert Panel on Pediatric Imaging, Hayes et al., 2012). At age 7 years, prevalence ranges from 37% to 51%. By age 15 years, 57% to 82% of children have experienced headaches. And among 16-year-olds, 93% or more have reported experiencing a severe headache (ACR Expert Panel on Pediatric Imaging, Hayes et al., 2012). Before puberty, boys are more likely than girls to experience headache. The situation is reversed after puberty, when headaches are more commonly reported in girls (ACR Expert Panel on Pediatric Imaging, Hayes et al., 2012).

Headache Pathology and Severity

Headaches can be classified as either primary (not a symptom of an underlying disease, condition, or trauma) or secondary (related to an existing condition). Examples of primary headaches include migraine and tension headaches. Examples of secondary headaches include headaches associated with dehydration, sinusitis, trauma, tumor, and vascular malformations. For the purposes of this measure, atraumatic headaches are considered to be primary headaches or secondary headaches unrelated to injury.

The precise pathophysiology of headaches is still not fully understood, but research suggests that complex interactions between the neural and vascular systems are involved (Edvinsson, 2001). The manifestation and perception of headache is unique and specific to the child who experiences it. Correspondingly, the management approach for children with headaches often focuses on reassurance and education by the clinician who evaluates the child (Brna et al., 2006; Raieli et al., 2010).

Burdens of Overuse of Imaging for Primary Headache: Radiation, Sedation/Anesthesia, and Intravenous Contrast Risks; Cost

The literature offers many examples of the potential risks associated with overuse of imaging. Chief among these are risks related to radiation (Mathews et al., 2013; Pearce et al., 2012), sedation and/or anesthesia (Malviya et al., 2000; Wachtel et al., 2009), and intravenous contrast media (Zo'o et al., 2011). Cost is also an issue (Callaghan et al., 2014).

<u>Radiation-Related Burden and Risk</u>

Radiation exposure associated with CT-imaging introduces the possibility of chronic health risks related to malignancies sustained from radiation effects (Berrington de González et al., 2009; Mathews et al., 2013; Pearce et al., 2012). Radiosensitive organs—including the brain, bone marrow, lens of the eye, and thyroid gland—can be exposed to radiation during CT of the head (Papadakis et al., 2011). In children younger than 5 years of age, about 20% of the active bone marrow is in the cranium, compared with 8% in adults (Cristy, 1981). CT-based radiation dose for pediatric patients is highly problematic because the developing cellular structures and tissues of children are significantly more radiosensitive than those of adults; children, therefore, will be at substantially elevated risk for malignancy (ACR Expert Panel on Pediatric Imaging, Hayes et al., 2012).

To conduct imaging studies with radiation dosing that is appropriate for children, many facilities follow policies and protocols using the concept of ALARA – As Low As Reasonably Achievable. ALARA principles deem any additional radiation beyond the minimum needed for interpretable images both detrimental and non-efficacious (ACR statement, 2009). Professional practice and patient advocacy groups including the ACR, the American Academy of Neurology (AAN), and the American Academy of Pediatrics (AAP) have developed and promoted ALARA protocols and policies; these guidelines support the use of CT imaging only when clinically indicated in children, decreasing the risk of harm from radiation.

Sedation and Anesthesia-Related Burden and Risk

Some children will require sedation to ensure minimal movement during CT studies. Use of sedation is necessary to avoid motion artifacts, which invariably occur if the child moves during image acquisition, thus interfering with image quality. Motion artifacts sometimes undermine imaging quality to the point of rendering images unreadable. In the case of CT imaging, this may result in additional radiation exposure to obtain images sufficient for interpretation. Although the sedation used for pediatric imaging has been identified as low risk, it does have potential attendant complications (Cravero et al., 2006; Malviya et al., 2000). Levels of sedation are on a continuum from minimal anxiolysis (administration of an anxiety reduction agent) to deep sedation, in which the patient can be roused only via vigorous stimuli (Arthurs and Sury, 2013). Compared with minimal sedation, moderate and deep sedation carry a greater risk of airway compromise, hypoxia resulting in central nervous system injury, and death (Cravero et al., 2006).

In certain instances, sedation may not be sufficient, and anesthesia will be required to complete imaging. Anesthesia includes administration of medication to the extent that there is some degree of respiratory suppression and potential for cardiac depression; the patient cannot be roused by external stimuli or commands (Arthurs and Sury, 2013). Administration of anesthesia raises risks related to the process of intubation for respiratory support. These risks include dental trauma; airway edema (swelling of the windpipe); vocal cord spasm or injury; regurgitation of stomach contents with subsequent aspiration (inhalation) pneumonia; injury to arteries, veins, or nerves; alterations in blood pressure; and/or irregular heart rhythms (Society for Pediatric Anesthesia, 2014). The most severe, though rare, risks include brain damage and death (Society for Pediatric Anesthesia, 2014).

Intravenous Contrast-Related Burden and Risk

During the course of CT studies, intravenous (IV) contrast media may be used to enhance visualization of vascular structures and provide important information about neurologic anatomy. It is possible a child may experience an allergic reaction to IV contrast or subcutaneous fluid leakage (extravasation) during administration of IV contrast. IV contrast administration also includes the risk of contrast-induced nephrotoxicity (CIN) (Medscape Drugs and Diseases, 2014; Zo'o et al. 2011). Children with poor kidney function are at greater risk for developing CIN and, in rare cases, will develop renal failure requiring dialysis.

Cost-Related Burden

Overuse of imaging is costly and places additional strain on an already heavily burdened health care system (Callaghan et al., 2014). As an example, charges for a CT of the brain can be as much as $2,000 and can vary substantially by region of the country. In addition, the likelihood that neuroimaging will result in the identification of clinically important structural abnormalities in this patient population is low. Incidental findings, however, may require follow-up testing with associated charges and potential complications (Lumbreras et al., 2010; Rogers et al., 2013).

Performance Gap

Currently, professional guidelines do not support neuroimaging for atraumatic headache in the absence of documented neurologic signs or symptoms that suggest increased intracranial pressure because the yield is low and imaging without an indication exposes children to unnecessary risks.

While many children with headaches will not benefit from neuroimaging, children experiencing secondary headaches associated with trauma, new neurologic deficits, or signs and symptoms of increased intracranial pressure may require timely imaging. CT is usually the initial imaging modality of choice for patients who require timely imaging in the acute clinical setting (ACR Expert Panel on Pediatric Imaging, Hayes et al., 2012). CT imaging is readily available in most emergency departments (Ginde et al., 2008) and is the preferred imaging modality for post-traumatic headaches with features concerning for intracranial hemorrhage (ACR Expert Panel on Pediatric Imaging, Hayes et al., 2012). The ACR Appropriateness Criteria (ACR Expert Panel on Pediatric Imaging, Hayes et al., 2012) rank MRI as more appropriate than CT in patients with atraumatic headache. MRI may be a reasonable alternative to CT for children with atraumatic headaches, even for the evaluation of time sensitive conditions such as failure of a ventricular-peritoneal shunt (Boyle et al., 2014; Kim et al., 2015). MRI will usually be the preferred modality instead of CT because MRI does not use radiation and tends to have improved spatial resolution.

This measure assesses the number of CT scans obtained without indication on or within 30 days after the date of evaluation for atraumatic headache among children, ages 4 through 17 years old. For the purposes of this measure, indications include thunderclap headache, vascular disease, infections, lumbar puncture, new neurologic deficit, or signs and symptoms of increased intracranial pressure.

A lower percentage indicates better performance, as reflected by avoidance of radiation exposure from CT when it is not indicated.

Drivers of Overuse

Headache experienced by a child, especially when recurrent, can be a stressful event that may prompt a parent to seek the assistance of a health care provider, at times emergently. Some providers may feel pressured by the parent to order imaging despite the lack of benefit (Daymont et al., 2014; Raieli et al., 2010). This circumstance has a close parallel to parents who seek out antibiotics for their child who has viral respiratory symptoms. In these circumstances, the provider may deviate from established practice guidelines to placate the parent. In recent decades, this phenomenon has reached such wide-spread prominence as to prompt multidisciplinary initiatives targeted at fostering discussion and identifying common practices that should be questioned by parents and providers

(AAP, Choosing Wisely, 2013). An ongoing dialogue between providers and parents continues to be a key feature of optimal outcomes in the setting of headache.

The practice of defensive medicine is another reason an imaging study may be ordered without a clear indication. Physicians may be uncomfortable facing uncertainty regarding the etiology of headache in children they are evaluating and treating. Assurance behaviors (e.g., ordering additional tests) are expected when a malpractice-sensitive physician is faced with a potentially worrisome condition that can cause the symptom in question (Carrier et al., 2013). In a survey of physicians from six specialties at high risk of liability, emergency physicians ordered more unnecessary diagnostic tests than clinicians from any other specialty (Studdert et al., 2005). Physicians practicing in the emergency department have the added challenge of limited access to detailed medical records, which increases uncertainty about prior evaluation of patients who are referred from an out-of-network provider or hospital. Overuse of neuroimaging is a potential result.

III.B. Evidence for Importance of the Measure to Medicaid and/or CHIP

Comment on any specific features of this measure important to Medicaid and/or CHIP that are in addition to the evidence of importance described above, including the following:

- The extent to which the measure is understood to be sensitive to changes in Medicaid or CHIP (e.g., policy changes, quality improvement strategies).
- Relevance to the Early and Periodic Screening, Diagnostic and Treatment benefit in Medicaid (EPSDT).[2]
- Any other specific relevance to Medicaid/CHIP (please specify).

Overuse of Imaging of Atraumatic Headaches and Medicaid/CHIP

Virtually any alteration in resource utilization or expenditure substantially affects children covered by Medicaid or CHIP; in 2011 alone, 30.6 million or 40% of children through the age of 18 years were Medicaid recipients (Tang et al., 2011). Although there is no study on the number of children with headache who are enrolled in Medicaid or CHIP, curtailing the overuse of imaging will favorably reduce radiation exposure, poor anesthesia or sedation outcomes, and costs.

III.C. Relationship to Other Measures (if any)

Describe, if known, how this measure complements or improves on an existing measure in this topic area for the child or adult population, or if it is intended to fill a specific gap in an existing measure category or topic. For example, the proposed measure may enhance an existing measure in the initial core set, it may lower the age range for an existing adult-focused

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[2] The EPSDT is a comprehensive set of benefits available to children and youth under age 21 who are enrolled in Medicaid. For more information, see http://www.healthlaw.org/images/stories/epsdt/3-ESDPT08.pdf.

measure, or it may fill a gap in measurement (e.g., for asthma care quality, inpatient care measures).

We are unaware of any existing quality measures specific to the overuse of CT imaging for children with atraumatic headache.

References for Section III

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Zo'o M, Hoermann M, Balassy C, et al. Renal safety in pediatric imaging: Randomized, double blind phase IV clinical trial of iobitridol 300 versus iodixanol 270 in multidetector CT. *Pediatr Radiol* 2011; 41(11); 1393-1400.

SECTION IV.
MEASURE CATEGORIES

CHIPRA legislation[3] requires that measures in the initial and improved core set, taken together, cover all settings, services, and topics of health care relevant to children. Moreover, the legislation requires the core set to address the needs of children across all ages,[4] including services to promote healthy birth. Regardless of the eventual use of the measure, we are interested in knowing all settings, services, measure topics, and populations that this measure addresses. These categories are not exclusive of one another, so please indicate "Yes" to all that apply.

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3 Children's Health Insurance Program Reauthorization Act of 2009. Public Law No. 111-3, 123 Stat. 8 (2009). Available at: http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_public_laws&docid=f:publ003.111.

4 Under Section 214 of CHIPRA, States may elect to cover the following groups under Medicaid only or under both Medicaid and CHIP: pregnant women and children up to age 19 for CHIP or up to age 21 for Medicaid.

	Does the measure address this category?	
a. Care Setting – ambulatory	**Yes**	
b. Care Setting – inpatient	**Yes**	
c. Care Setting – other—please specify	**No**	
d. Service – preventive health	**No**	
e. Service – care for acute conditions	**Yes**	
f. Service - care for children with special health care needs/chronic conditions	**Yes**	
g. Service – health promotion and services to promote healthy birth	**No**	
h. Service-other (please specify)	**No**	
i. Measure Topic -duration of enrollment	**No**	
j. Measure Topic – clinical quality	**Yes**	
k. Measure Topic – patient safety	**Yes**	
l. Measure Topic – family experience with care	**No**	
m. Measure Topic – care in the most integrated setting	**No**	
n. Measure Topic – other (please specify)	**No**	
o. Population – pregnant women	**No**	
p. Population – neonates (28 days after birth) (specify age range)	**No**	
q. Population – infants (29 days to 1 year) (specify age range)	**No**	
r. Population – pre-school age children (1 year through 5 years) (specify age range)	**Yes**	Ages 4 through 5 years
s. Population – school-age children (6 years through 10 years) (specify age range)	**Yes**	All ages in this range
t. Population – adolescents (11 years through 20 years) (specify age range)	**Yes**	Adolescents 11 through 17 years

SECTION V.
EVIDENCE OR OTHER JUSTIFICATION FOR THE FOCUS OF THE MEASURE

The evidence base for the focus of the measures will be made explicit and transparent as part of the public release of CHIPRA deliberations; thus, it is critical for submitters to specify the scientific evidence or other basis for the focus of the measure in the following sections.

V.A. Research Evidence

Research evidence should include a brief description of the evidence base for valid relationship(s) among the structure, process, and/or outcome of health care that is the focus of the measure. For example, evidence exists for the relationship between immunizing a child or adolescent (process of care) and improved outcomes for the child and the public. If sufficient evidence existed for the use of immunization registries in practice or at the State level and the provision of immunizations to children and adolescents, such evidence would support the focus of a measure on immunization registries (a structural measure).

Describe the nature of the evidence, including study design, and provide relevant citations for statements made. Evidence may include rigorous systematic reviews of research literature and high-quality research studies.

This measure assesses the number of CT scans obtained without indication on or within 30 days after the date of evaluation for atraumatic headache among children, ages 4 through 17 years old. Well-established evidence shows that neuroimaging to characterize headache in the absence of documented neurologic signs or symptoms that suggest intracranial pathology is rarely clinically indicated and is potentially harmful (ACR Expert Panel on Pediatric Imaging, Hayes et al., 2012; Lateef, Grewal et al., 2009). When imaging is deemed necessary, providers must weigh the risks of radiation exposure and possibly sedation or anesthesia complications with the benefits of the available imaging modalities.

Table 8 summarizes key sources of evidence for this measure, using the US Preventive Services Task Force (USPSTF) rankings (criteria denoted in a note to the table). The ACR, in addition to evidence-based guidelines noted below, has also published specific "Appropriateness Criteria" for pediatric headache (Figures 1 and 2).

Table 8: Evidence Regarding Overuse of Computed Tomography Imaging for Atraumatic Headache in Children

TYPE OF EVIDENCE	KEY FINDINGS	LEVEL OF EVIDENCE (USPSTF RANKING*)	CITATION(S)
Appropriateness criteria	The ACR has completed multiple comprehensive, evidence-based reviews of radiologic literature, clinical practice literature, and expert consultation. In summary, the ACR has advised that headaches in the absence of documented neurologic signs or symptoms that suggest intracranial hemorrhage usually do not require evaluation with imaging.	III	American College of Radiology Expert Panel on Pediatric Imaging: Hayes LL, Coley BD, Karmazyn B, et al. ACR Appropriateness Criteria: Headache — child. American College of Radiology, revised 2012. Available at: https://acsearch.acr.org/docs/69439/Narrative/ accessed April 21, 2015.
Retrospective observational study	DeVries et al. conducted a retrospective, observational cohort analysis using more than 15,000 commercial claims related to the care of children ages 3 to 17 years old with recurrent headache compiled from HealthCore. One quarter of children with recurrent headache in the cohort underwent CT imaging. Twenty-three percent of children in the cohort underwent MRI during the study period. Although emergency department visits were associated with CT scans, two-thirds of patients with CT scans had no emergency department use. There were a variety of provider types seen for the index diagnosis of headache including pediatrics (43%), family medicine (30%), neurology (3%) and other (23%).	II	DeVries A, Young PC, Wall E, et al. CT scan utilization patterns in pediatric patients with recurrent headache. *Pediatrics* 2013; 132(1):e1-e8.
Retrospective observational study	Lateef et al. examined the records of 364 children 2 to 5 years of age who presented with headache to a large urban emergency department between July 1, 2003 and June 30, 2006. Of these children, 58 (16%) had a primary headache. CT imaging was obtained in 16 of the 58 children with primary headache; only one CT scan yielded abnormal results. The child with abnormal results on the CT scan also had abnormalities on neurologic examination.	II	Lateef TM, Grewal M, McClintock W, Chamberlain J, Kaulas H, Nelson KB. Headache in young children in the emergency department: Use of computed tomography. *Pediatrics* 2009; 124:1 e12-e17.

TYPE OF EVIDENCE	KEY FINDINGS	LEVEL OF EVIDENCE (USPSTF RANKING*)	CITATION(S)
Practice parameter	Lewis et al. reviewed the available evidence on diagnostic testing of the child with recurrent headaches and made recommendations for evaluation of children, 3 to 18 years old with headaches, based on this evidence. The authors concluded that headaches occur commonly in children and are diagnosed on a clinical basis. They specifically recommend the following regarding neuroimaging: 1) Obtaining a neuroimaging study on a routine basis is not indicated in children with recurrent headaches and a normal neurologic examination. 2) Neuroimaging should be considered in children with an abnormal neurologic exam (e.g., focal findings, signs of increased intracranial pressure, significant alteration of consciousness), the coexistence of seizures, or both. 3) Neuroimaging should be considered in children in whom there are historical features to suggest the recent onset of severe headache, change in the type of headache, or if there are associated features that suggest neurologic dysfunction.	III	Lewis DW, Ashwal S, Dahl G, et al. Practice parameter: Evaluation of children and adolescents with recurrent headaches: Report of the Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society. *Neurology* 2002; 59(4):490-498.
Retrospective analysis	Chu et al. reviewed charts of 104 children with onset of headaches before 7 years of age who were seen by a neurologist before 10 years of age between July 1983 and July 1989. Migraine was the predominant headache type, present in 75% of cases where headaches could be classified. Thirty children underwent CT scans (n=23) or MRI (n=7) and abnormalities were found in five cases. Three of the five cases had previous abnormal CT scans.	II	Chu ML, Shinnar Sl. Headaches in children younger than 7 years of age. *Arch Neurol* 1992; 49(1):79-82.

Note: USPSTF criteria for assessing evidence at the individual study level are as follows: I) Properly-powered and conducted randomized controlled trial (RCT); well-conducted systematic review or meta-analysis of homogeneous RCTs. II) Well-designed cohort or case-control analytic study. III) Opinions of respected authorities, based on clinical experience; descriptive studies or case reports; reports of expert committees.

Figure 1

American College of Radiology
ACR Appropriateness Criteria®

Clinical Condition: Headache — Child

Variant 1: Primary headache (chronic or recurrent headache including migraine without permanent neurologic signs or signs of increased intracranial pressure).

Radiologic Procedure	Rating	Comments	RRL*
MRI head without contrast	3		O
MRI head without and with contrast	3		O
CT head without contrast	2		☢☢☢
CT head with contrast	1		☢☢☢
CT head without and with contrast	1		☢☢☢☢
CTA head with contrast	1		☢☢☢☢
MRA head without contrast	1		O
MRA head without and with contrast	1		O
Arteriography cerebral	1		☢☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Figure 2

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
☢	<0.1 mSv	<0.03 mSv
☢☢	0.1-1 mSv	0.03-0.3 mSv
☢☢☢	1-10 mSv	0.3-3 mSv
☢☢☢☢	10-30 mSv	3-10 mSv
☢☢☢☢☢	30-100 mSv	10-30 mSv
*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (eg, region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies".		

From: American College of Radiology Expert Panel on Pediatric Imaging: Hayes LL, Coley BD, Karmazyn B, et al. ACR Appropriateness Criteria: Headache — child. American College of Radiology, revised 2012. Available at: https://acsearch.acr.org/docs/69439/Narrative/ accessed April 21, 2015.

V.B. Clinical or Other Rationale Supporting the Focus of the Measure (optional)

Provide documentation of the clinical or other rationale for the focus of this measure, including citations as appropriate and available.

SECTION VI.
SCIENTIFIC SOUNDNESS OF THE MEASURE

Explain the methods used to determine the scientific soundness of the measure itself. Include results of all tests of validity and reliability, including description(s) of the study sample(s) and methods used to arrive at the results. Note how characteristics of other data systems, data sources, or eligible populations may affect reliability and validity.

VI.A. Reliability

Reliability of the measure is the extent to which the measure results are reproducible when conditions remain the same. The method for establishing the reliability of a measure will depend on the type of measure, data source, and other factors. Explain your rationale for selecting the methods you have chosen, show how you used the methods chosen, and provide information on the results (e.g., the Kappa statistic). Provide appropriate citations to justify methods.

To evaluate the reliability of using administrative claims for the calculation of this measure, we conducted a signal-to-noise analysis. This analysis was focused on assessing the ability to confidently distinguish the performance of one state health plan from that of another state. To perform the signal-to-noise analysis, we used the Medicaid Analytic eXtract (MAX) administrative claims data provided by the Centers for Medicare & Medicaid Services (CMS) from 2006 to 2010 for seven diverse state Medicaid programs: Colorado, Florida, Illinois, Massachusetts, Michigan, Texas, and Utah. The number of CT scans per state and year are summarized in Table 9. Proportion of CT imaging without indication varied between states, ranging from a low of 79.8% in 2006 (Michigan) to a high of 90.5% in 2006 (Texas). Lowest to highest proportion of CT imaging without indication within each state across the 5-year period were as follows: Colorado (81.5% to 84.8%); Florida (86.3% to 87.7&); Illinois (86.9% to 88.8%); Massachusetts (84.7% to 87.8%); Michigan (79.8% to 85.2%); Texas (85.1% to 90.5%); and Utah (81.9% to 88.9%).

For this approach, reliability was estimated with a beta-binomial model (RAND Corporation, TR-653-NCQA, 2009). We tested the reliability using aggregate data from these seven states, 2006-2010.

Reliability Results

Reliability results are detailed in Table 10. These results show that the reliability based on signal-to-noise analysis ranged from 0.61 to 0.99, with a median of 0.96.

Table 9: Number of CT Scans Performed without Indication within 30 Days of Evaluation for Atraumatic Headache among Eligible Children in Seven States – MAX Data

		2006	2007	2008	2009	2010
COLORADO	Numerator	312	390	383	424	429
	Denominator	381	460	470	504	516
	Percentage	81.9%	84.8%	81.5%	84.1%	83.1%

		2006	2007	2008	2009	2010
FLORIDA	Numerator	1850	1696	2076	1844	3623
	Denominator	2116	1933	2389	2109	4196
	Percentage	87.4%	87.7%	86.9%	87.4%	86.3%

		2006	2007	2008	2009	2010
ILLINOIS	Numerator	4006	4340	4835	5585	5326
	Denominator	4514	4919	5481	6352	6128
	Percentage	88.8%	88.2%	88.2%	87.9%	86.9%

		2006	2007	2008	2009	2010
MASSACHUSETTS	Numerator	449	448	372	438	188
	Denominator	520	510	439	517	219
	Percentage	86.4%	87.8%	84.7%	84.7%	85.8%

		2006	2007	2008	2009	2010
MICHIGAN	Numerator	494	1779	2799	2933	2770
	Denominator	619	2089	3364	3499	3343
	Percentage	79.8%	85.2%	83.2%	83.8%	82.9%

		2006	2007	2008	2009	2010
TEXAS	Numerator	2960	3181	3350	4131	4428
	Denominator	3271	3668	3849	4854	5079
	Percentage	90.5%	86.7%	87.0%	85.1%	87.2%

		2006	2007	2008	2009	2010
UTAH	Numerator	101	120	122	119	113
	Denominator	117	135	149	139	132
	Percentage	86.3%	88.9%	81.9%	85.6%	85.6%

Table 10. State Medicaid Plan Reliability for Measure

State	Numerator	Denominator	Reliability
Colorado	1938	2331	0.82
Florida	11089	12743	0.97
Illinois	24092	27394	0.99
Massachusetts	1895	2205	0.84
Michigan	10775	12914	0.96
Texas	18050	20721	0.98
Utah	575	672	0.61
Median (range)			**0.96 (0.61-0.99)**

Reliability Conclusions

In general, reliability scores can range from 0.0 (all variation is attributable to measurement error) to 1.0 (all variation is caused by real differences). While there is not a clear cut-off for a minimum reliability level, values above 0.7 are considered sufficient to distinguish differences between some health plans and the mean; reliability values above 0.9 are considered sufficient to see differences between health plans (RAND Corporation, TR-653-NCQA, 2009). In states where the denominator is large (at least 2,000 events), the reliability is very good; observed reliability was consistently greater than 0.80. However, in Utah, where the denominator is 672 CT imaging events, reliability was lower (0.61). This suggests that this measure should be used in health plans with over 2,000 CT imaging events in the denominator to facilitate comparisons between plans; comparison of this measure among smaller health plans should be interpreted with caution.

VI.B. Validity

Validity of the measure is the extent to which the measure meaningfully represents the concept being evaluated. The method for establishing the validity of a measure will depend on the type of measure, data source, and other factors. Explain your rationale for selecting the methods you have chosen, show how you used the methods chosen, and provide information on the results (e.g., R^2 for concurrent validity). Provide appropriate citations to justify methods.

Face Validity

Face validity is the degree to which the measure construct characterizes the concept being assessed. The face validity of this measure was established by a national panel of experts and parent representatives for families of children with headache and seizures convened by Q-METRIC. The Q-METRIC panel included nationally recognized experts in the area of imaging children, representing

general pediatrics, pediatric radiology, pediatric neurology, pediatric neurosurgery, pediatric emergency medicine, general emergency medicine, and family medicine. In addition, face validity of this measure was considered by experts in state Medicaid program operations, health plan quality measurement, health informatics, and health care quality measurement. In total, the Q-METRIC imaging panel included 15 experts, providing a comprehensive perspective on imaging children and the measurement of quality metrics for states and health plans.

The Q-METRIC expert panel concluded that this measure has a high degree of face validity through a detailed review of concepts and metrics considered to be essential to appropriately image children. Concepts and draft measures were rated by this group for their relative importance. This measure received an average score of 7.3 (with 9 as the highest possible score).

SECTION VII.
IDENTIFICATION OF DISPARITIES

CHIPRA requires that quality measures be able to identify disparities by race, ethnicity, socioeconomic status, and special health care needs. Thus, we strongly encourage nominators to have tested measures in diverse populations. Such testing provides evidence for assessing measure's performance for disparities identification. In the sections below, describe the results of efforts to demonstrate the capacity of this measure to produce results that can be stratified by the characteristics noted and retain the scientific soundness (reliability and validity) within and across the relevant subgroups.

VII.A. Race/Ethnicity

The data collected for performance scores did not include race/ethnicity information.

VII.B. Special Health Care Needs

The data collected for performance scores did not include information about special health care needs.

VII.C. Socioeconomic Status

The data collected for performance scores did not include information about socioeconomic status.

VII.D. Rurality/Urbanicity

The data collected for performance scores did not include information about rurality or urbanicity.

VII.E. Limited English Proficiency (LEP) Populations

The data collected for performance scores did not include information about LEP.

SECTION VIII.
FEASIBILITY

Feasibility is the extent to which the data required for the measure are readily available, retrievable without undue burden, and can be implemented for performance measurement.[5] Using the following sections, explain the methods used to determine the feasibility of implementing the measure.

VIII.A. Data Availability

VIII.A.1. What is the availability of data in existing data systems? How readily are the data available?

This measure was tested using administrative claims. Administrative data needed for this measure include date of birth, diagnosis, revenue and procedure codes, and dates. These data are generally available, although obtaining them may require a restricted-use data agreement and Institutional Review Board (IRB) approval.

VIII.A.2. If data are not available in existing data systems or would be better collected from future data systems, what is the potential for modifying current data systems or creating new data systems to enhance the feasibility of the measure and facilitate implementation?

Continuing advances in the development and implementation of electronic health records (EHRs) may prompt providers to document key elements needed for application of inclusion and exclusion criteria necessary for this measure. Advances would further allow for electronic capture of structured clinical information needed to determine if and when CT imaging has been overused in the evaluation of children experiencing atraumatic headache without indication of thunderclap headache, vascular disease, infections, lumbar puncture, new neurologic deficit, or signs and symptoms of increased intracranial pressure.

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[5] The definition is adapted from: Centers for Medicare & Medicaid Services Quality Measurement and Health Assessment Group glossary, as part of the Measures Management System Measure Development Overview. Available at: http://www.cms.gov/MMS/19_MeasuresManagementSystemBlueprint.asp#TopOfPage. Accessed February 6, 2012.

VIII.B. Lessons from Use of the Measure

VIII.B.1. Describe the extent to which the measure has been used or is in use, including the types of settings in which it has been used, and purposes for which it has been used.

To our knowledge, this measure is not currently in use anywhere in the United States.

VIII.B.2. If the measure has been used or is in use, what methods, if any, have already been used to collect data for this measure?

Not applicable

VIII.B.3. What lessons are available from the current or prior use of the measure?

Not applicable

SECTION IX.
LEVELS OF AGGREGATION

CHIPRA states that data used in quality measures must be collected and reported in a standard format that permits comparison (at minimum) at State, health plan, and provider levels. Use the following table to provide information about this measure's use for reporting at the levels of aggregation in the table.

For the purpose of this section, please refer to the definitions for provider, practice site, medical group, and network in Section XVI. Glossary of Terms.

If there is no information about whether the measure could be meaningfully reported at a specific level of aggregation, please write "Not available" in the text field before progressing to the next section. Table IX-1 shows the questions (in columns) about the measure's use at different levels of aggregation for quality reporting (in rows) included in the CHIPRA PQMP Candidate Measure Submission Form (CPCF).

Table IX-1. Questions about the measure's use at different levels of aggregation for quality reporting

Level of aggregation (Unit) for reporting on the quality of care for children covered by Medicaid/CHIP[†]	**Intended use: Is measure intended to support meaningful comparisons at this level? (Yes/No)**	**Data Sources: Are data sources available to support reporting at this level?**	**Sample Size: What is the typical sample size available for each unit at this level? What proportion of units at this level of aggregation can achieve an acceptable minimum sample size?**	**In Use: Have measure results been reported at this level previously?**	**Reliability & Validity: Is there published evidence about the reliability and validity of the measure when reported at this level of aggregation?**	**Unintended consequences: What are the potential unintended consequences of reporting at this level of aggregation?**
State level*: Can compare States	☐Yes ☒No	NA	NA	NA	NA	NA
Other geographic level: Can compare other geographic regions (e.g., MSA, HRR)	☐Yes ☒No	NA	NA	NA	NA	NA
Medicaid or CHIP Payment model: Can compare payment models (e.g., managed care, atraumatic care case management, FFS, and other models)	☐Yes ☒No	NA	NA	NA	NA	NA
Health plan*: Can compare quality of care among health plans.	☒Yes ☐No	This measure requires administrative claims.	We recommend at least 2,000 CT scans for evaluation of an atraumatic headache be vailable within a health plan to allow for reliable comparisons between health plans.	NA	NA	NA
Provider-level* Individual practitioner: Can compare individual health care professionals	☐Yes ☒No	NA	NA	NA	NA	NA
Hospital: Can compare hospitals	☒Yes ☐No	This measure requires administrative claims.	This measure has not been tested at the hospital level, and, consequently, the minimum number of patients per hospital has not been determined.	NA	NA	NA

Level of aggregation (Unit) for reporting on the quality of care for children covered by Medicaid/CHIP†	Intended use: Is measure intended to support meaningful comparisons at this level? (Yes/No)	Data Sources: Are data sources available to support reporting at this level?	Sample Size: What is the typical sample size available for each unit at this level? What proportion of units at this level of aggregation can achieve an acceptable minimum sample size?	In Use: Have measure results been reported at this level previously?	Reliability & Validity: Is there published evidence about the reliability and validity of the measure when reported at this level of aggregation?	Unintended consequences: What are the potential unintended consequences of reporting at this level of aggregation?
Practice, group, or facility:** Can compare: (i) practice sites; (ii) medical or other professional groups; or (iii) integrated or other delivery networks	☐Yes ☒No	NA	NA	NA	NA	NA

NA = Not applicable

† There could be other levels of reporting that could be of interest to Medicaid agencies such as markets and referral regions.

***** Required in CHIPRA legislation.

****** There is no implication that measures that are applicable at one level are automatically applicable at all three of the levels listed in this row.

SECTION X.
UNDERSTANDABILITY

CHIPRA states that the core set should allow purchasers, families, and health care providers to understand the quality of care for children. Please describe the usefulness of this measure toward achieving this goal. Describe efforts to assess the understandability of this measure (e.g., focus group testing with stakeholders).

This measure provides families with a means to assess the extent to which CT studies are being overused for the evaluation of children with atraumatic headache. This measure has not been formally assessed for comprehension. However, high rates of overuse are easily understood to be unsatisfactory. The simplicity of the measure likewise makes it a straightforward guide for providers and purchasers to assess overuse of CT for the evaluation of children with atraumatic headache. The primary information needed for this measure is sourced from administrative claims data and includes basic demographics, diagnostic codes, and procedure codes, all of which are widely available.

SECTION XI.
HEALTH INFORMATION TECHNOLOGY

Please respond to the following questions in terms of any health information technology (health IT) that has been or could be incorporated into the calculation of the measure.

XI.A. Health IT Enhancement

Please describe how health IT may enhance the use of this measure.

Health information technology (IT) provides a platform that can support various new uses of the measure. First, health IT can show feedback at the time of order entry. Health IT can also provide education about alternatives to imaging. Alerts and reminders, given to patients as well as providers, might also enhance use.

XI.B. Health IT Testing

Has the measure been tested as part of an electronic health record (EHR) or other health IT system?

No

If so, in what health IT system was it tested and what were the results of testing?

Not applicable

XI.C. Health IT Workflow

Please describe how the information needed to calculate the measure may be captured as part of routine clinical or administrative workflow.

This information will be captured through order entry systems. Importantly, for this measure to be accurate, it may be necessary to combine data from multiple electronic health record (EHR) systems. The use of Health Information Exchange (HIE), especially using the DIRECT protocol for exchange across individual EMRs, would be an important tactical step to enable this measure. Another change is the need to identify when a neurological baseline has been achieved, so that orders after that time can be recorded for the measure.

XI.D. Health IT Standards

Are the data elements in this measure supported explicitly by the Office of the National Coordinator for Health IT Standards and Certification criteria (see: http://healthit.hhs.gov/portal/server.pt/community/healthit_hhs_gov__standards_ifr/1195)?

Yes

If yes, please describe.

The ONC standards include the following specific requirements in the Certification criteria (Federal Register, 2010) pertaining to Stage 2 Meaningful Use requirements:

Stage 2 (beginning in 2013): CMS has proposed that its goals for the Stage 2 meaningful use criteria expand upon the Stage 1 criteria to encourage the use of health IT for continuous quality improvement at the point of care. In addition, the exchange of information in the most structured format possible is encouraged. This can be accomplished through mechanisms such as the electronic transmission of orders entered using computerized provider order entry (CPOE) and the electronic transmission of diagnostic test results. Electronic transmission of diagnostic test results includes a broad array of data important to quality measurement and, for this measure, specifically includes radiology studies such as CT imaging and the radiation dose delivered.

XI.E. Health IT Calculation

Please assess the likelihood that missing or ambiguous information will lead to calculation errors.

Missing or ambiguous information in the following areas could lead to missing cases or calculation errors:

1. Child's date of birth
2. ICD-9-CM or ICD-10-CM codes
3. Date and time of treatment
4. Type of tests administered
5. Date of tests performed
6. Care setting
7. Lack of a consistent radiation dose monitoring strategy
8. Possibly a scanned or electronic clinical document in the medical record

XI.F. Health IT Other Functions

If the measure is implemented in an EHR or other health IT system, how might implementation of other health IT functions (e.g., computerized decision support systems in an EHR) enhance performance on the measure?

This measure, as noted above, requires the use of HIE for optimal understanding of previous imaging studies. For many sites, duplicative testing is an alternate to HIE, which may be impossible in the early mornings or at off hours from a primary care site. Implementation of HIE is one aspect that will enhance performance. Another might be the use of clinical decision support to understand when CT is not indicated. Information buttons could link to educational resources at the point of care to

discourage unnecessary ordering and could be used to link previous study results with the act of ordering, which has been shown to decrease the rate of ordering.

References for Section XI Health IT

Health information technology: Initial set of standards, implementation specifications, and certification criteria for electronic health record technology. *Fed Regist* 2010; 75(8): 2013-2047.

SECTION XII.
LIMITATIONS OF THE MEASURE

Describe any limitations of the measure related to the attributes included in this CPCF (i.e., availability of measure specifications, importance of the measure, evidence for the focus of the measure, scientific soundness of the measure, identification of disparities, feasibility, levels of aggregation, understandability, health information technology).

This measure assesses the number of CT scans obtained without indication on or within 30 days after the date of evaluation for atraumatic headache among children, ages 4 through 17 years old. For the purposes of this measure, indications for CT imaging include thunderclap headache, vascular disease, infections, lumbar puncture, new neurologic deficit, or signs and symptoms of increased intracranial pressure. A lower percentage indicates better performance, as reflected by avoidance of CT imaging when it is not indicated.

In future implementations, some considerations may further strengthen this measure and potentially ease the burden of data collection. Continuing advances in the development and implementation of EHRs may prompt providers to document key elements needed for application of inclusion and exclusion criteria necessary for this measure.

In future implementation, we recommend considering the inclusion of the *ordering* of neuroimaging studies as opposed to limiting the measure to *obtained* neuroimaging studies. This would address the potential for delays between the time an order is placed and the time that a study can be scheduled. Including orders for neuroimaging studies decreases the potential for underestimation of overuse that would occur if a study could not be obtained within the 30-day timeframe set for this measure. In addition, future specifications may consider including a denominator exclusion of a documented contraindication to MRI, as CT would be the only imaging option in this population.

SECTION XIII.
SUMMARY STATEMENT

Provide a summary rationale for why the measure should be selected for use, taking into account a balance among desirable attributes and limitations of the measure. Highlight specific advantages that this measure has over alternative measures on the same topic that were considered by the measure developer or specific advantages that this measure has over existing measures. If there is any information about this measure that is important for the review process but has not been addressed above, include it here.

This measure assesses the number of CT scans obtained without indication on or within 30 days after the date of evaluation for atraumatic headache among children, ages 4 through 17 years old. For the purposes of this measure, indications for neuroimaging include thunderclap headache, vascular disease, infections, lumbar puncture, new neurologic deficit, or signs and symptoms of increased intracranial pressure. A lower percentage indicates better performance, as reflected by avoidance of CT imaging when it is not indicated. This measure was tested using administrative claims data. There are currently no known existing quality measures specific to CT imaging of children with atraumatic headache.

Headaches are common in the pediatric population, and children with headaches are frequently evaluated in emergency department and primary care settings. As a diagnostic tool, CT scans are simple to order because the technology is readily available and image acquisition is fast. However, CT imaging for children with an atraumatic headache who lack any indication of trauma, intracranial hemorrhage, or other time-sensitive conditions yields little information and exposes children to unnecessary risk from radiation. Children who have CT scans in early childhood tend to be at greater risk for developing leukemia, primary brain tumors, and other malignancies later in life. Young children are also at risk for complications from sedation or anesthesia, which are often required for longer CT imaging sequences. In addition, the cost burden associated with imaging is high.

Q-METRIC testing results indicate that this measure is feasible using existing data sources. This measure is specified using administrative claims. The proportion of children who received a CT image without indication after an atraumatic headache ranged from approximately 80%-90% across seven state Medicaid programs from 2006-2010.

This measure provides families with a means to assess the extent to which CT studies are being overused for the evaluation of children with atraumatic headache. High rates of overuse are easily understood to be unsatisfactory. The primary information needed for this measure includes basic demographics, diagnostic codes, and procedure codes, all of which are widely available, though access may require a restricted-use data agreement and IRB approval. Advances would further allow for electronic capture of clinical information needed to determine if and when neuroimaging has been overused in the evaluation of children experiencing an atraumatic headache.

SECTION XIV.
IDENTIFYING INFORMATION FOR THE MEASURE SUBMITTER

Complete information about the person submitting the material, including the following:

a. Gary L. Freed, MD, MPH

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g. Signed written statement guaranteeing that all aspects of the measure will be publicly available, as defined in the Public Disclosure Requirements.

Public Disclosure Requirements

Each submission must include a written statement agreeing that, should U.S. Department of Health and Human Services accept the measure for the 2016 Improved Core Measure Sets, full measure specifications for the accepted measure will be subject to public disclosure (e.g., on the Agency for Healthcare Research and Quality [AHRQ] and/or Centers for Medicare & Medicaid Services [CMS] websites), except that potential measure users will not be permitted to use the measure for commercial use. In addition, AHRQ expects that measures and full measure specifications will be made reasonably available to all interested parties. "Full measure specifications" is defined as all information that any potential measure implementer will need to use and analyze the measure, including use and analysis within an electronic health record or other health information technology. As used herein, "commercial use" refers to any sale, license or distribution of a measure for commercial gain, or incorporation of a measure into any product or service that is sold, licensed or distributed for commercial gain, even if there is no actual charge for inclusion of the measure. This statement must be signed by an individual authorized to act for any holder of copyright on each submitted measure or instrument. The authority of the signatory to provide such authorization should be described in the letter. (Section XIV: Identifying Information for the Measure Submitter).

This work was funded by the Agency for Healthcare Research and Quality (AHRQ) and the Centers for Medicare & Medicaid Services (CMS) under the CHIPRA Pediatric Quality Measures Program Centers of Excellence grant number U18 HS020516. AHRQ, in accordance to CHIPRA 42 U.S.C. Section 1139A(b), and consistent with AHRQ's mandate to disseminate research results, 42 U.S.C. Section 299c-3, has a worldwide irrevocable license to use and permit others to use products and materials from the grant for government purposes, which may include making the materials available for verification or replication by other researchers and making them available to the health care community and the public, if such distribution would significantly increase access to a product and thereby produce substantial or valuable public health benefits.

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Overuse of Imaging

Overuse of Computed Tomography Scans for the Evaluation of Children with Atraumatic Headache

Description

This measure assesses the number of computed tomography (CT) scans obtained without indication on or within 30 days after the date of evaluation for atraumatic headache among children, ages 4 through 17 years old. For the purposes of this measure, indications for CT imaging include thunderclap headache, vascular disease, infections, lumbar puncture, new neurologic deficit, or signs and symptoms of increased intracranial pressure. A lower percentage indicates better performance, as reflected by avoidance of CT imaging when it is not indicated.

Calculation

This measure requires administrative data and is calculated as follows:

> The percentage of CT scans obtained without indication on or within 30 days after the date of evaluation of atraumatic headache among children, ages 4 through 17 years old (numerator divided by denominator).

Eligible Population

Ages	Children at least 4 years old on January 1 of the measurement year but younger than 18 years old on December 31 of the measurement year.
Enrollment	Continuous enrollment during both the measurement year and the year prior to the measurement year.
Event/Diagnosis	CT imaging studies of the head (Table IMG1) for the evaluation of atraumatic headache (Table IMG3) occurring on the day of or up to 30 days prior to imaging. (Note, IMG tables begin on page 43.)

Specification

Denominator	The number of CT scans obtained on or within 30 days after the date of evaluation for atraumatic headache among children, ages 4 through 17 years of age.

Numerator	The number of CT scans obtained without indication on or within 30 days after the date of evaluation for atraumatic headache among children, ages 4 through 17 years old.

Exclusions

- **Denominator/Numerator Exclusions**
    - Trauma-related headache or pain (Table IMG3) on the day of or within 7 days prior to imaging
    - Head trauma or suspected abuse/neglect (Table IMG9) or the presence of an E-code in claims data) on the day of or within 7 days prior to imaging
    - Imaging study obtained on the day of or within 180 days following neurosurgical intervention (Table IMG10)

- **Numerator Exclusions**
    - New neurologic deficits or signs or symptoms of increased intracranial pressure (Table IMG11) between the date of diagnosis and imaging study
    - Thunderclap headache (Table IMG3) on the day of or within 365 days prior to imaging
    - Vascular disease (Table IMG8) on the day of or within 365 days prior to imaging
    - Infections that would warrant imaging on the day of or within the 365 days before the atraumatic headache (Table IMG4)
    - Lumbar puncture (Table IMG10) during the visit (same date/date after) where imaging was obtained

Table 1 [=IMG1]: Codes to Identify Neuroimaging in Administrative Claims

IMAGING MODALITY	CODE TYPE	CODES
Computerized Tomography (CT) of Brain/Head	Revenue (UB-92)	350, 351, 352, 353, 354, 355, 356, 357, 358, 359
	CPT	70450, 70460, 70470, 70480, 70481,70482
	ICD-9-CM	87.03

Table 2 [=IMG3]: Headaches by ICD-9-CM Code

Diagnosis Category	Diagnosis Details	ICD-9-CM Code
Migraine		
	Migraine with aura	346.0
	Migraine without aura	346.1
	Variants of migraine, not elsewhere classified (abdominal migraine, cyclical vomiting, ophthalmoplegic migraine, periodic headache syndromes in child or adolescent)	346.2
	Hemiplegic migraine	346.3
	Menstrual migraine	346.4
	Persistent migraine aura w/o cerebral infarction	346.5
	Persistent migraine aura WITH cerebral infarction	346.6
	Chronic migraine without aura	346.7
	Other forms of migraine	346.8
	Migraine, unspecified	346.9
Headache syndromes		
	Tension type headache	399.1x
	Tension headache NOS/related to psych factors	307.81
	Cluster headaches/other trigeminal autonomic cephaligias	339.0x
	Drug induced headache	339.3
	Hypnic headache	339.81
	Primary stabbing headache	339.85
	"Other"	339.89
Complicated headache syndromes		
	Hemicranius continua	339.41
	New daily persistent	339.42
	Primary thunderclap	339.43
	Other complicated	339.44
OTHER		
Post-traumatic headache		339.2x
Acute pain due to trauma		338.11
General Symptoms	Headache	784.0

Table 3 [=IMG11]: Signs and Symptoms of Increased Intracranial Pressure or Herniation

Diagnosis Category	Diagnosis Detail	ICD-9-CM Code	Definition
Visual disturbances	Diplopia	368.2	Double vision
Other disorders of eyelids	Ptosis	374.3	Drooping of the eyelid
Disorders of the optic nerve and visual pathways	Papilledema	377.0x	Swelling of the optic disc on fundcoscopic exam
Paralytic strabismus			Abnormal eye movements
	Unspecified	378.50	
	Third/oculomotor nerve palsy	378.5x	
	Forth/trochlear nerve palsy	378.53	
	Sixth/abducens nerve palsy	378.54	
Irregular eye movements	Nystagmus, unspecified	379.50	
Pupillary function	Anisocoria	379.41	Unequal pupils
Vertigo of central origin		386.2	Sensation of spinning
General symptoms			
	Alteration of consciousness	780.0	
	Coma	780.01	
	Transient alteration of awareness	780.02	
	Persistent vegetative state	780.03	
	Other (drowsiness, semicoma, somnolence, stupor, unconsciousness)	780.09	
	Dizziness and giddiness	780.4	
	Altered mental status	780.97	
	Abnormality of gait	781.2	Not walking normally
	Lack of coordination	781.3	Dysmetria on finger-nose-finger
	Transient paralysis of limb	781.4	
	Ocular torticollis	781.93	
	Facial weakness	781.94	
Persistent vomiting		536.2	Report of “morning vomiting”
Other			
	Compression of the brain	348.4	
	Cerebral edema	348.5	

Table 4 [=IMG8]: Vascular Disease

General Diagnosis	Diagnosis Detail	ICD-9-CM Code
Hemangioma of unspecified site (includes cavernous malformation)		228.00
Phlebitis/thrombophlebitis of intracranial venous sinuses		325
Occlusion and stenosis of precerebral arteries	Basilar artery	433.0
	Carotid artery	433.1
	Vertebral artery	433.2
	Multiple and bilateral	433.3
	Other specified	433.8
	Unspecified	433.9
Occlusion of the cerebral arteries	Cerebral thrombosis	434.0
	Cerebral embolism	434.1
	Cerebral artery occlusion	434.9
Transient cerebral ischemia	Basilar artery syndrome, vertebral artery syndrome, etc	435.x
Cerebral aneurysm, nonruptured		437.3
Moyamoya disease		437.5
Nonpyogenic thrombosis of intracranial venous sinus		437.6
Other congenital anomalies of the circulatory system	Coartcation of the aorta	747.1
	Other anomalies of the aorta	747.2x
Other specified anomalies of circulatory system (includes anteriovenous malformation)	Cerebrovascular anomalies	747.81
	Other (aneurysm)	747.89
Other venous embolism/thrombosis unspecified site		753.9
Other and unspecified intracranial hemorrhage		432.x
Personal history of other certain diseases	TIA and cerebral infarction	V12.5

Table 5 [=IMG4]: Infection

General Diagnosis	Diagnosis Detail	ICD-9-CM Code
Amebic brain abscess		006.5
Tuberculosis of meninges and central nervous system		013.0
Meningococcal meningitis		036.0
HIV		042
Meningitis due to enterovirus		047
Other enterovirus diseases of the central nervous system		048
Other non-arthropod-borne viral diseases of central nervous system		049
Postvaricella encephalitis		052.0
Herpes zoster with meningitis		053.0
Herpetic meningoencephalitis		054.3
Herpes simplex meningitis		054.72
Postmeasles encephalitis		055.0
Rubella with neurological complications		056.0x
Other human herpesvirus encephalitis		058.2
Mosquito-borne viral encephalitis		062.x
Tick-borne viral encephalitis		063.x
Viral encephalitis transmitted by other and unspecified arthropods		064
West Nile fever with encephalitis		066.41
Mumps meningitis/encephalitis		072.1, 072.2
Meningitis		
	Bacterial	320.xx
	Other organisms	321.x
	Unspecified cause	322.x
Encephalitis, myelitis, encephalomyelitis		323.xx
Intracranial and intraspinal abscess		324.x

Table 6 [=IMG10]: Lumbar Puncture and Recent Neurosurgical Procedures

NOTE: Spinal tap procedures must be performed on the same date as the imaging to qualify as an exclusion. Neurosurgery procedures may be performed anytime during the 365 days prior to, or the day of, imaging to qualify as an exclusion.

PROCEDURE	CPT CODE
SPINAL TAP	
Spinal puncture lumbar diagnostic	62270
Spinal tap	03.31
Anesthesia for dx or therapeutic lumbar puncture	635
NEUROSURGERY	
Transcatheter placement of extracranial cerebrovascular artery stent(s), percutaneous; initial vessel	0005T
Each additional vessel (list separately in addition to code for primary procedure)	0006T
Transcatheter placement of extracranial cerebrovascular artery stent(s), percutaneous, radiological supervision and interpretation, each vessel	0007T
Anesthesia for intracranial procedures; not otherwise specified	00210
Anesthesia for intracranial procedures; craniotomy or craniectomy for evacuation of hematoma	00211
Anesthesia for intracranial procedures; subdural taps	00212
Anesthesia for intracranial procedures; burr holes, including ventriculography	00214
Anesthesia for intracranial procedures; cranioplasty or elevation of depressed skull fracture, extradural (simple or compound)	00215
Anesthesia for intracranial procedures; vascular procedures	00216
Anesthesia for intracranial procedures; procedures in sitting position	00218
Anesthesia for intracranial procedures; cerebrospinal fluid shunting procedures	00220
Anesthesia for intracranial procedures; electrocoagulation of intracranial nerve	00222
Stereotactic placement of infusion catheter(s) in the brain for delivery of therapeutic agent(s), including computerized stereotactic planning and burr hole(s)	0169T
Anesthesia for therapeutic interventional radiological procedures involving the arterial system; intracranial, intracardiac, or aortic	01926
Anesthesia for therapeutic interventional radiological procedures involving the venous/lymphatic system (not to include access to the central circulation); intracranial	01933
Ventricular puncture through previous burr hole, fontanelle, suture, or implanted ventricular catheter/reservoir; without injection	61020
Ventricular puncture through previous burr hole, fontanelle, suture, or implanted ventricular catheter/reservoir; with injection of medication or other substance for diagnosis or treatment	61026
Cisternal or lateral cervical (c1-c2) puncture; without injection (separate procedure)	61050
Cisternal or lateral cervical (c1-c2) puncture; with injection of medication or other substance for diagnosis or treatment (eg, c1-c2)	61055

Puncture of shunt tubing or reservoir for aspiration or injection procedure	61070
Twist drill hole for subdural or ventricular puncture	61105
Twist drill hole for subdural or ventricular puncture; followed by other surgery	61106
Twist drill hole for subdural or ventricular puncture; for implanting ventricular catheter or pressure recording device	61107
Twist drill hole for subdural or ventricular puncture; for evacuation and/or drainage of subdural hematoma	61108
Burr hole(s) for ventricular puncture (including injection of gas, contrast media, dye, or radioactive material); followed by other surgery	61130
Burr hole(s) or trephine; with biopsy of brain or intracranial lesion	61140
Burr hole(s) or trephine; with drainage of brain abscess or cyst	61150
Burr hole(s) or trephine; with subsequent tapping (aspiration) of intracranial abscess or cyst	61151
Burr hole(s) with evacuation and/or drainage of hematoma, extradural or subdural	61154
Burr hole(s); with aspiration of hematoma or cyst, intracerebral	61156
Burr hole(s); for implanting ventricular catheter, reservoir, eeg electrode(s), pressure recording device, or other cerebral monitoring device (separate procedure)	61210
Insertion of subcutaneous reservoir, pump or continuous infusion system for connection to ventricular catheter	61215
Burr hole(s) or trephine, supratentorial, exploratory, not followed by other surgery	61250
Burr hole(s) or trephine, infratentorial, unilateral or bilateral	61253
Craniectomy or craniotomy, exploratory; supratentorial	61304
Craniectomy or craniotomy, exploratory; infratentorial (posterior fossa)	61305
Craniectomy or craniotomy for evacuation of hematoma, supratentorial; extradural or subdural	61312
Craniectomy or craniotomy for evacuation of hematoma, supratentorial; intracerebral	61313
Craniectomy or craniotomy for evacuation of hematoma, infratentorial; extradural or subdural	61314
Craniectomy or craniotomy for evacuation of hematoma, infratentorial; intracerebellar	61315
Incision and subcutaneous placement of cranial bone graft (list separately in addition to code for primary procedure)	61316
Craniectomy or craniotomy, drainage of intracranial abscess; supratentorial	61320
Craniectomy or craniotomy, drainage of intracranial abscess; infratentorial	61321
Craniectomy or craniotomy, decompressive, with or without duraplasty, for treatment of intracranial hypertension, without evacuation of associated intraparenchymal hematoma; without lobectomy	61322
Craniectomy or craniotomy, decompressive, with or without duraplasty, for treatment of intracranial hypertension, without evacuation of associated intraparenchymal hematoma; with lobectomy	61323
Decompression of orbit only, transcranial approach	61330
Exploration of orbit (transcranial approach); with biopsy	61332
Exploration of orbit (transcranial approach); with removal of lesion	61333
Exploration of orbit (transcranial approach); with removal of foreign body	61334
Subtemporal cranial decompression (pseudotumor cerebri, slit ventricle syndrome)	61340
Craniectomy, suboccipital with cervical laminectomy for decompression of medulla and spinal cord, with or without dural graft (eg, arnold-chiari malformation)	61343
Other cranial decompression, posterior fossa	61345

Craniotomy for section of tentorium cerebelli (separate procedure)	61440
Craniectomy, subtemporal, for section, compression, or decompression of sensory root of gasserian ganglion	61450
Craniectomy, suboccipital; for exploration or decompression of cranial nerves	61458
Craniectomy, suboccipital; for section of one or more cranial nerves	61460
Craniectomy, suboccipital; for medullary tractotomy	61470
Craniectomy, suboccipital; for mesencephalic tractotomy or pedunculotomy	61480
Craniotomy for lobotomy, including cingulotomy	61490
Craniectomy; with excision of tumor or other bone lesion of skull	61500
Craniectomy; for osteomyelitis	61501
Craniectomy, trephination, bone flap craniotomy; for excision of brain tumor, supratentorial, except meningioma	61510
Craniectomy, trephination, bone flap craniotomy; for excision of meningioma, supratentorial	61512
Craniectomy, trephination, bone flap craniotomy; for excision of brain abscess, supratentorial	61514
Craniectomy, trephination, bone flap craniotomy; for excision or fenestration of cyst, supratentorial	61516
Implantation of brain intracavitary chemotherapy agent (list separately in addition to code for primary procedure)	61517
Craniectomy for excision of brain tumor, infratentorial or posterior fossa; except meningioma, cerebellopontine angle tumor, or midline tumor at base of skull	61518
Craniectomy for excision of brain tumor, infratentorial or posterior fossa; meningioma	61519
Craniectomy for excision of brain tumor, infratentorial or posterior fossa; cerebellopontine angle tumor	61520
Craniectomy for excision of brain tumor, infratentorial or posterior fossa; midline tumor at base of skull	61521
Craniectomy, infratentorial or posterior fossa; for excision of brain abscess	61522
Craniectomy, infratentorial or posterior fossa; for excision or fenestration of cyst	61524
Craniectomy, bone flap craniotomy, transtemporal (mastoid) for excision of cerebellopontine angle tumor;	61526
Craniectomy, bone flap craniotomy, transtemporal (mastoid) for excision of cerebellopontine angle tumor; combined with middle/posterior fossa craniotomy/craniectomy	61530
Subdural implantation of strip electrodes through one or more burr or trephine hole(s) for long term seizure monitoring	61531
Craniotomy with elevation of bone flap; for subdural implantation of an electrode array, for long term seizure monitoring	61533
Craniotomy with elevation of bone flap; for excision of epileptogenic focus without electrocorticography during surgery	61534
Craniotomy with elevation of bone flap; for removal of epidural or subdural electrode array, without excision of cerebral tissue (separate procedure)	61535
Craniotomy with elevation of bone flap; for excision of cerebral epileptogenic focus, with electrocorticography during surgery (includes removal of electrode array)	61536
Craniotomy with elevation of bone flap; for lobectomy, temporal lobe, without electrocorticography during surgery	61537
Craniotomy with elevation of bone flap; for lobectomy with electrocorticography during surgery, temporal lobe	61538
Craniotomy with elevation of bone flap; for lobectomy with electrocorticography during	61539

surgery, other than temporal lobe, partial or total	
Craniotomy with elevation of bone flap; for lobectomy, other than temporal lobe, partial or total, without electrocorticography during surgery	61540
Craniotomy with elevation of bone flap; for transection of corpus callosum	61541
Craniotomy with elevation of bone flap; for total hemispherectomy	61542
Craniotomy with elevation of bone flap; for partial or subtotal (functional) hemispherectomy	61543
Craniotomy with elevation of bone flap; for excision or coagulation of choroid plexus	61544
Craniotomy with elevation of bone flap; for excision of craniopharyngioma	61545
Craniotomy for hypophysectomy or excision of pituitary tumor, intracranial approach	61546
Hypophysectomy or excision of pituitary tumor, transnasal or transseptal approach, nonstereotactic	61548
Craniectomy for craniosynostosis; single cranial suture	61550
Craniectomy for craniosynostosis; multiple cranial sutures	61552
Craniotomy for craniosynostosis; frontal or parietal bone flap	61556
Craniotomy for craniosynostosis; bifrontal bone flap	61557
Extensive craniectomy for multiple cranial suture craniosynostosis (eg, cloverleaf skull); not requiring bone grafts	61558
Extensive craniectomy for multiple cranial suture craniosynostosis (eg, cloverleaf skull); recontouring with multiple osteotomies and bone autografts (eg, barrel-stave procedure) (includes obtaining grafts)	61559
Excision, intra and extracranial, benign tumor of cranial bone (eg, fibrous dysplasia); without optic nerve decompression	61563
Excision, intra and extracranial, benign tumor of cranial bone (eg, fibrous dysplasia); with optic nerve decompression	61564
Craniotomy with elevation of bone flap; for selective amygdalohippocampectomy	61566
Craniotomy with elevation of bone flap; for multiple subpial transections, with electrocorticography during surgery	61567
Craniectomy or craniotomy; with excision of foreign body from brain	61570
Craniectomy or craniotomy; with treatment of penetrating wound of brain	61571
Transoral approach to skull base, brain stem or upper spinal cord for biopsy, decompression or excision of lesion;	61575
Transoral approach to skull base, brain stem or upper spinal cord for biopsy, decompression or excision of lesion; requiring splitting of tongue and/or mandible (including tracheostomy)	61576
Craniofacial approach to anterior cranial fossa; extradural, including lateral rhinotomy, ethmoidectomy, sphenoidectomy, without maxillectomy or orbital exenteration	61580
Craniofacial approach to anterior cranial fossa; extradural, including lateral rhinotomy, orbital exenteration, ethmoidectomy, sphenoidectomy and/or maxillectomy	61581
Craniofacial approach to anterior cranial fossa; extradural, including unilateral or bifrontal craniotomy, elevation of frontal lobe(s), osteotomy of base of anterior cranial fossa	61582
Craniofacial approach to anterior cranial fossa; intradural, including unilateral or bifrontal craniotomy, elevation or resection of frontal lobe, osteotomy of base of anterior cranial fossa	61583
Orbitocranial approach to anterior cranial fossa, extradural, including supraorbital ridge osteotomy and elevation of frontal and/or temporal lobe(s); without orbital exenteration	61584
Orbitocranial approach to anterior cranial fossa, extradural, including supraorbital ridge osteotomy and elevation of frontal and/or temporal lobe(s); with orbital exenteration	61585
Bicoronal, transzygomatic and/or lefort i osteotomy approach to anterior cranial fossa	61586

with or without internal fixation, without bone graft	
Infratemporal pre-auricular approach to middle cranial fossa (parapharyngeal space, infratemporal and midline skull base, nasopharynx), with or without disarticulation of the mandible, including parotidectomy, craniotomy, decompression and/or mobilization of the facial nerve and/or petrous carotid artery	61590
Infratemporal post-auricular approach to middle cranial fossa (internal auditory meatus, petrous apex, tentorium, cavernous sinus, parasellar area, infratemporal fossa) including mastoidectomy, resection of sigmoid sinus, with or without decompression and/ or mobilization of contents of auditory canal or petrous carotid artery	61591
Orbitocranial zygomatic approach to middle cranial fossa (cavernous sinus and carotid artery, clivus, basilar artery or petrous apex) including osteotomy of zygoma, craniotomy, extra- or intradural elevation of temporal lobe	61592
Transtemporal approach to posterior cranial fossa, jugular foramen or midline skull base, including mastoidectomy, decompression of sigmoid sinus and/or facial nerve, with or without mobilization	61595
Transcochlear approach to posterior cranial fossa, jugular foramen or midline skull base, including labyrinthectomy, decompression, with or without mobilization of facial nerve and/or petrous carotid artery	61596
Transcondylar (far lateral) approach to posterior cranial fossa, jugular foramen or midline skull base, including occipital condylectomy, mastoidectomy, resection of c1-c3 vertebral body(s), decompression of vertebral artery, with or without mobilization	61597
Transpetrosal approach to posterior cranial fossa, clivus or foramen magnum, including ligation of superior petrosal sinus and/or sigmoid sinus	61598
Resection or excision of neoplastic, vascular or infectious lesion of base of anterior cranial fossa; extradural	61600
Resection or excision of neoplastic, vascular or infectious lesion of base of anterior cranial fossa; intradural, including dural repair, with or without graft	61601
Resection or excision of neoplastic, vascular or infectious lesion of infratemporal fossa, parapharyngeal space, petrous apex; extradural	61605
Resection or excision of neoplastic, vascular or infectious lesion of infratemporal fossa, parapharyngeal space, petrous apex; intradural, including dural repair, with or without graft	61606
Resection or excision of neoplastic, vascular or infectious lesion of parasellar area, cavernous sinus, clivus or midline skull base; extradural	61607
Resection or excision of neoplastic, vascular or infectious lesion of parasellar area, cavernous sinus, clivus or midline skull base; intradural, including dural repair, with or without graft	61608
Transection or ligation, carotid artery in cavernous sinus; without repair (list separately in addition to code for primary procedure)	61609
Transection or ligation, carotid artery in cavernous sinus; with repair by anastomosis or graft (list separately in addition to code for primary procedure)	61610
Transection or ligation, carotid artery in petrous canal; without repair (list separately in addition to code for primary procedure)	61611
Transection or ligation, carotid artery in petrous canal; with repair by anastomosis or graft (list separately in addition to code for primary procedure)	61612
Obliteration of carotid aneurysm, arteriovenous malformation, or carotid-cavernous fistula by dissection within cavernous sinus	61613
Resection or excision of neoplastic, vascular or infectious lesion of base of posterior cranial fossa, jugular foramen, foramen magnum, or c1-c3 vertebral bodies; extradural	61615
Resection or excision of neoplastic, vascular or infectious lesion of base of posterior cranial fossa, jugular foramen, foramen magnum, or c1-c3 vertebral bodies; intradural, including dural repair, with or without graft	61616

Secondary repair of dura for cerebrospinal fluid leak, anterior, middle or posterior cranial fossa following surgery of the skull base; by free tissue graft (eg, pericranium, fascia, tensor fascia lata, adipose tissue, homologous or synthetic grafts)	61618
Secondary repair of dura for cerebrospinal fluid leak, anterior, middle or posterior cranial fossa following surgery of the skull base; by local or regionalized vascularized pedicle flap or myocutaneous flap (including galea, temporalis, frontalis or occipitalis muscle)	61619
Endovascular temporary balloon arterial occlusion, head or neck (extracranial/intracranial) including selective catheterization of vessel to be occluded, positioning and inflation of occlusion balloon, concomitant neurological monitoring, and radiologic supervision and interpretation of all angiography required for balloon occlusion and to exclude vascular injury post occlusion	61623
Transcatheter permanent occlusion or embolization (eg, for tumor destruction, to achieve hemostasis, to occlude a vascular malformation), percutaneous, any method; central nervous system (intracranial, spinal cord)	61624
Transcatheter permanent occlusion or embolization (eg, for tumor destruction, to achieve hemostasis, to occlude a vascular malformation), percutaneous, any method; non-central nervous system, head or neck (extracranial, brachiocephalic branch)	61626
Balloon angioplasty, intracranial (eg, atherosclerotic stenosis), percutaneous	61630
Transcatheter placement of intravascular stent(s), intracranial (eg, atherosclerotic stenosis), including balloon angioplasty, if performed	61635
Balloon dilatation of intracranial vasospasm, percutaneous; initial vessel	61640
Balloon dilatation of intracranial vasospasm, percutaneous; each additional vessel in same vascular family (list separately in addition to code for primary procedure)	61641
Balloon dilatation of intracranial vasospasm, percutaneous; each additional vessel in different vascular family (list separately in addition to code for primary procedure)	61642
Surgery of intracranial arteriovenous malformation; supratentorial, simple	61680
Surgery of intracranial arteriovenous malformation; supratentorial, complex	61682
Surgery of intracranial arteriovenous malformation; infratentorial, simple	61684
Surgery of intracranial arteriovenous malformation; infratentorial, complex	61686
Surgery of intracranial arteriovenous malformation; dural, simple	61690
Surgery of intracranial arteriovenous malformation; dural, complex	61692
Surgery of complex intracranial aneurysm, intracranial approach; carotid circulation	61697
Surgery of complex intracranial aneurysm, intracranial approach; vertebrobasilar circulation	61698
Surgery of simple intracranial aneurysm, intracranial approach; carotid circulation	61700
Surgery of simple intracranial aneurysm, intracranial approach; vertebrobasilar circulation	61702
Surgery of intracranial aneurysm, cervical approach by application of occluding clamp to cervical carotid artery (Selverstone-Crutchfield type)	61703
Surgery of aneurysm, vascular malformation or carotid-cavernous fistula; by intracranial and cervical occlusion of carotid artery	61705
Surgery of aneurysm, vascular malformation or carotid-cavernous fistula; by intracranial electrothrombosis	61708
Surgery of aneurysm, vascular malformation or carotid-cavernous fistula; by intra-arterial embolization, injection procedure, or balloon catheter	61710
Anastomosis, arterial, extracranial-intracranial (eg, middle cerebral/cortical) arteries	61711
Microdissection, intracranial or spinal procedure (list separately in addition to code for primary procedure)	61712
Creation of lesion by stereotactic method, including burr hole(s) and localizing and recording techniques, single or multiple stages; globus pallidus or thalamus	61720

Creation of lesion by stereotactic method, including burr hole(s) and localizing and recording techniques, single or multiple stages; subcortical structure(s) other than globus pallidus or thalamus	61735
Stereotactic biopsy, aspiration, or excision, including burr hole(s), for intracranial lesion;	61750
Stereotactic biopsy, aspiration, or excision, including burr hole(s), for intracranial lesion; with computed tomography and/or magnetic resonance guidance	61751
Stereotactic implantation of depth electrodes into the cerebrum for long term seizure monitoring	61760
Stereotactic localization, including burr hole(s), with insertion of catheter(s) or probe(s) for placement of radiation source	61770
Stereotactic computer-assisted (navigational) procedure; cranial, intradural (list separately in addition to code for primary procedure)	61781
Stereotactic computer-assisted (navigational) procedure; cranial, extradural (list separately in addition to code for primary procedure)	61782
Stereotactic computer-assisted (navigational) procedure; spinal (list separately in addition to code for primary procedure)	61783
Stereotactic radiosurgery (particle beam, gamma ray or linear accelerator), one or more sessions	61793
Stereotactic computer assisted volumetric (navigational) procedure, intracranial, extracranial, or spinal (list separately in addition to code for primary procedure)	61795
Stereotactic radiosurgery (particle beam, gamma ray, or linear accelerator); 1 simple cranial lesion	61796
Stereotactic radiosurgery (particle beam, gamma ray, or linear accelerator); each additional cranial lesion, simple (list separately in addition to code for primary procedure)	61797
Stereotactic radiosurgery (particle beam, gamma ray, or linear accelerator); 1 complex cranial lesion	61798
Stereotactic radiosurgery (particle beam, gamma ray, or linear accelerator); each additional cranial lesion, complex (list separately in addition to code for primary procedure)	61799
Application of stereotactic headframe for stereotactic radiosurgery (list separately in addition to code for primary procedure)	61800
Twist drill or burr hole(s) for implantation of neurostimulator electrodes, cortical	61850
Twist drill or burr hole(s) for implantation of neurostimulator electrodes; subcortical	61855
Craniectomy or craniotomy for implantation of neurostimulator electrodes, cerebral, cortical	61860
Twist drill, burr hole, craniotomy, or craniectomy for stereotactic implantation of one neurostimulator array in subcortical site (eg, thalamus, globus pallidus, subthalamic nucleus, periventricular, periaqueductal gray)	61862
Twist drill, burr hole, craniotomy, or craniectomy with stereotactic implantation of neurostimulator electrode array in subcortical site (eg, thalamus, globus pallidus, subthalamic nucleus, periventricular, periaqueductal gray), without use of intraoperative microelectrode recording; first array	61863
Twist drill, burr hole, craniotomy, or craniectomy with stereotactic implantation of neurostimulator electrode array in subcortical site (eg, thalamus, globus pallidus, subthalamic nucleus, periventricular, periaqueductal gray), without use of intraoperative microelectrode recording; each additional array (list separately in addition to primary procedure)	61864
Craniectomy or craniotomy for implantation of neurostimulator electrodes, cerebral; subcortical	61865
Twist drill, burr hole, craniotomy, or craniectomy with stereotactic implantation of neurostimulator electrode array in subcortical site (eg, thalamus, globus pallidus,	61867

subthalamic nucleus, periventricular, periaqueductal gray), with use of intraoperative microelectrode recording; first array	
Twist drill, burr hole, craniotomy, or craniectomy with stereotactic implantation of neurostimulator electrode array in subcortical site (eg, thalamus, globus pallidus, subthalamic nucleus, periventricular, periaqueductal gray), with use of intraoperative microelectrode recording; each additional array (list separately in addition to primary procedure)	61868
Craniectomy for implantation of neurostimulator electrodes, cerebellar; cortical	61870
Craniectomy for implantation of neurostimulator electrodes, cerebellar; subcortical	61875
Revision or removal of intracranial neurostimulator electrodes	61880
Incision and subcutaneous placement of cranial neurostimulator pulse generator or receiver, direct or inductive coupling; with connection to a single electrode array	61885
Incision and subcutaneous placement of cranial neurostimulator pulse generator or receiver, direct or inductive coupling; with connection to two or more electrode arrays	61886
Revision or removal of cranial neurostimulator pulse generator or receiver	61888
Elevation of depressed skull fracture; simple, extradural	62000
Elevation of depressed skull fracture; compound or comminuted, extradural	62005
Elevation of depressed skull fracture; with repair of dura and/or debridement of brain	62010
Craniotomy for repair of dural/cerebrospinal fluid leak, including surgery for rhinorrhea/otorrhea	62100
Reduction of craniomegalic skull (eg, treated hydrocephalus); not requiring bone grafts or cranioplasty	62115
Reduction of craniomegalic skull (eg, treated hydrocephalus); with simple cranioplasty	62116
Reduction of craniomegalic skull (eg, treated hydrocephalus); requiring craniotomy and reconstruction with or without bone graft (includes obtaining grafts)	62117
Repair of encephalocele, skull vault, including cranioplasty	62120
Craniotomy for repair of encephalocele, skull base	62121
Cranioplasty for skull defect; up to 5 cm diameter	62140
Cranioplasty for skull defect; larger than 5 cm diameter	62141
Removal of bone flap or prosthetic plate of skull	62142
Replacement of bone flap or prosthetic plate of skull	62143
Cranioplasty for skull defect with reparative brain surgery	62145
Cranioplasty with autograft (includes obtaining bone grafts); up to 5 cm diameter	62146
Cranioplasty with autograft (includes obtaining bone grafts); larger than 5 cm diameter	62147
Incision and retrieval of subcutaneous cranial bone graft for cranioplasty (list separately in addition to code for primary procedure)	62148
Neuroendoscopy, intracranial, for placement or replacement of ventricular catheter and attachment to shunt system or external drainage (list separately in addition to code for primary procedure)	62160
Neuroendoscopy, intracranial; with dissection of adhesions, fenestration of septum pellucidum or intraventricular cysts (including placement, replacement, or removal of ventricular catheter)	62161
Neuroendoscopy, intracranial; with fenestration or excision of colloid cyst, including placement of external ventricular catheter for drainage	62162
Neuroendoscopy, intracranial; with retrieval of foreign body	62163
Neuroendoscopy, intracranial; with excision of brain tumor, including placement of external ventricular catheter for drainage	62164
Neuroendoscopy, intracranial; with excision of pituitary tumor, transnasal or trans-	62165

sphenoidal approach	
Ventriculocisternostomy (Torkildsen type operation)	62180
Creation of shunt; subarachnoid/subdural-atrial, -jugular, -auricular	62190
Creation of shunt; subarachnoid/subdural-peritoneal, -pleural, other terminus	62192
Replacement or irrigation, subarachnoid/subdural catheter	62194
Ventriculocisternostomy, third ventricle;	62200
Ventriculocisternostomy, third ventricle; stereotactic, neuroendoscopic method	62201
Creation of shunt; ventriculo-atrial, -jugular, -auricular	62220
Creation of shunt; ventriculo-peritoneal, -pleural, other terminus	62223
Replacement or irrigation, ventricular catheter	62225
Replacement or revision of cerebrospinal fluid shunt, obstructed valve, or distal catheter in shunt system	62230
Removal of complete cerebrospinal fluid shunt system; without replacement	62256
Removal of complete cerebrospinal fluid shunt system; with replacement by similar or other shunt at same operation	62258

Table 7 [=IMG9]: Head Trauma and Intracranial Hemorrhage

General Diagnosis	Diagnosis Detail	ICD-9-CM Code
Post-traumatic headache		339.2x
Concussion	With no loss of consciousness	850.0
	With brief loss of consciousness	850.1
Fracture of skull	Closed w/o mention of intracranial injury	800.0
	Closed with cerebral laceration and contusion	800.1
	Closed with subarachnoid, subdural and extradural hemorrhage	800.2
	Closed with other and unspecified intracranial hemorrhage	800.3
	Closed with intracranial injury of other and unspecified nature	800.4
	Open w/o mention of intracranial injury	800.5
	Open with cerebral laceration and contusion	800.6
	Open with subarachnoid, subdural and extradural hemorrhage	800.7
	Open with other and unspecified intracranial hemorrhage	800.8
	Open with intracranial injury of other, unspecified nature	800.9
	Fracture of skull base	801.x
	Other, unqualified skull fracture	803.x
	Multiple fractures involving skull or face with other bones	804.x
Concussion	With loss of consciousness (LOC) 30min or less	850.11
	With LOC 31 minutes to 59 minutes	850.12
	With moderate LOC (1-24 hours)	850.2
	With prolonged LOC and return to pre-existing conscious level	850.3
	With prolonged LOC, without return to pre-existing conscious level	850.4
	With loss of consciousness of unspecified duration	850.5
	Concussion, unspecified	850.9
	Cerebral laceration and contusion	851.x
	Subarachnoid, subdural, extradural hemorrhage post injury	852.x
	Other/unspecified intracranial hemorrhage following injury	853.x
	Intracranial injury of other and unspecified nature	854.x
	Subarachnoid hemorrhage	430
	Intracerebral hemorrhage	431
	Other and unspecified intracranial hemorrhage	432.x
	Child abuse and neglect	995.5x
	Observation and evaluation for – abuse and neglect	V71.81
	Late effect of fracture of skull and face bones	905.0
	Late effect of intracranial injury without mention of skull fracture	907.0