SECTION I.
BASIC MEASURE INFORMATION

I.A. Measure Name

Overuse of Computed Tomography Scans for the Evaluation of Children with a First Generalized Afebrile, Atraumatic Seizure

I.B. Measure Citation Information

Macy ML, Freed GL, Reeves SL, Madden BW, McCormick J, Faasse T, Dombkowski KJ for the Quality Measurement Evaluation, Testing, Review, and Implementation Consortium. Overuse of computed tomography scans for the evaluation of children with a first generalized afebrile, atraumatic seizure. National Quality Measures Clearinghouse, Rockville (MD): Agency for Healthcare Research and Quality (AHRQ). Published July 4, 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 percentage of children, ages 1 through 17 years old, for whom computed tomography (CT) imaging of the head is obtained for the evaluation of a first generalized afebrile, atraumatic seizure without indication for CT imaging. For the purposes of this measure, indications for CT imaging include status epilepticus, signs of increased intracranial pressure, notably different mental state compared with prior exams, or an abnormal neurologic exam. A lower percentage indicates better performance, as reflected by avoiding CT imaging when it is not indicated.

Seizures are common; every year, it is anticipated that up to 40,000 children in the United States will experience a first afebrile seizure (Hirtz et al., 2000). Neuroimaging is used in pediatric patients who have experienced a seizure to evaluate for structural brain abnormalities that may require surgical intervention or predispose to future seizures. Clinical guidelines maintain that children who present for evaluation after a first, generalized, afebrile seizure and meet low-risk criteria can be safely discharged without emergent neuroimaging, if follow-up can be assured (Gaillard et al., 2009; Hirtz et al., 2000). While widely available, CT imaging for the evaluation of seizure in children has inferior resolution compared with magnetic resonance imaging (MRI) (Gaillard et al., 2009; Hirtz et al., 2000) and is generally low-yield (Aprahamian et al., 2014; Garvey et al., 1998; Maytal et al., 2000; Sharma et al., 2003; Warden et al., 1997), suggesting overuse of this imaging modality.

This measure will address the overuse of CT of the brain among children evaluated for a first, afebrile seizure who return to neurologic baseline after the event. 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 when a follow-up MRI study will be necessary creates cost burdens for the patient, as well as for payers.

This measure uses medical record data after administrative claims data are used to identify the eligible population. It is calculated as the percentage of eligible children, ages 1 through 17 years old, for whom CT imaging of the head is obtained for the evaluation of a first generalized afebrile, atraumatic seizure without indication for CT imaging.

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 Seizures 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 children, ages 1 through 17 years old, for whom CT imaging of the head is obtained for the evaluation of a first generalized afebrile, atraumatic seizure without indication for CT imaging.

Eligible children must be ages 1 through 17 years old during the measurement year during 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 1-9 and Table 11 can be found in this document beginning on page 51). International Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM) codes to identify afebrile, atraumatic seizure are shown in Table 2 [=IMG2]. Seizure must occur on the day of or up to 30 days prior to imaging. Afebrile, atraumatic seizures are those not associated, respectively, with fever or 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 clinical documentation:
    - Status epilepticus
    - Neurologic signs of increased intracranial pressure
    - Notably different mental state when compared with the child's own prior exams
    - An abnormal neurologic exam between the time of diagnosis and the time of imaging

I.I. Denominator Statement

The denominator is the number of children, ages 1 through 17 years old, for whom CT imaging of the head is obtained for the evaluation of a first generalized afebrile, atraumatic seizure.

Eligible children must be ages 1 through 17 years old during the measurement year during 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. Seizure must occur on the day of or up to 30 days prior to imaging. Table 1 [=IMG1] lists CPT codes associated with CT imaging of the head. ICD-9-CM codes to identify afebrile, atraumatic seizure are shown in Table 2 [=IMG2]. Afebrile, atraumatic seizures are those not associated, respectively, with fever or with trauma occurring in the 7 days prior to imaging.

I.J. Denominator Exclusions (as appropriate)

The following are excluded from the denominator:

- Exclusions based on ICD-9-CM codes captured in administrative claims data:
    - Partial seizure (Table 2 [=IMG2]) on the day of or within the 365 days before imaging was obtained
    - Fever (by ICD-9 codes 780.6x) on the day of or day before imaging was obtained
    - Complex febrile seizure (Table 2 [=IMG2]) on the day of or within the 365 days before the first generalized afebrile, atraumatic seizure in the measurement year
    - Post-traumatic seizure (Table 2 [=IMG2]) on the day of or day before imaging was obtained
    - Suspected abuse and neglect or other head trauma (Table 3 [=IMG9] or the presence of an E-code in claims data) on the day of or within 7 days before imaging was obtained
    - ICD-9 codes 783.40 (lack of expected normal physiological development) or 783.42 (delayed milestones) on the day of or within the 365 days before the first generalized afebrile, atraumatic seizure in the measurement year
    - Other pre-existing conditions that would warrant imaging (Tables 4-7 [=IMG5-IMG8]) on the day of or within 365 days before imaging was obtained
    - Infections that would warrant imaging on the day of or within the 365 days before the atraumatic seizure (Table 8 [=IMG4])
    - Lumbar puncture (Table 9 [=IMG10]) on the day of or day after imaging was obtained
    - Imaging study obtained on the day of or within the 180 days following neurosurgical intervention (Table 9 [=IMG10])
- Exclusions based on clinical documentation:
    - Partial seizure
    - Fever
    - Complex febrile seizure
    - Post-traumatic seizure
    - Trauma such as skull fracture, concussion, intracranial hemorrhage and suspected abuse
    - Developmental delay, lack of expected normal physiological development or delayed milestone
    - Pre-existing conditions that would warrant imaging such as neoplasm and blood disorder, hydrocephalus and central nervous system (CNS) anomalies, hemangioma, phlebitis/ thrombophlebitis, occlusion of cerebral arteries, moyamoya disease, tumor, hemorrhage, or tuberous sclerosis
    - Infection such as meningitis, brain abscess, HIV, and encephalitis
    - Lumbar puncture

- Imaging as part of surgical evaluation for seizure management (pre-operative or post-operative) on the day of or within the 30 days prior to the generalized afebrile, atraumatic seizure
- Neurological surgery

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**
2. Paper Medical Record	**X**
3. Survey – Health care professional report	
4. Survey – Parent/caregiver report	
5. Survey – Child report	
6. Electronic Medical Record	**X**
7. Other (If other, please list all other data sources in the field below.)	

This measure uses medical record data after administrative claims are used to identify the eligible population. The conversion to ICD-10-CM codes has been performed and is available in the Appendix.

References for Section I:

Aprahamian N, Harper MB, Prabhu SP. Pediatric first time non-febrile seizure with focal manifestations: Is emergent imaging indicated? *Seizure* 2014; 23(9):740-745.

Gaillard WD, Chiron C, Cross JH et al. Guidelines for imaging infants and children with recent-onset epilepsy. *Epilepsia* 2009; 50(9):2147-2153.

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Lawson EH, Gibbons MM, Ko CY, Shekelle PG. The appropriateness method has acceptable reliability and validity for assessing overuse and underuse of surgical procedures. *J Clin Epidemiol* 2012; 65(11):1133-1143.

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Maytal J, Krauss JM, Novak G, et al. The role of brain computed tomography in evaluating children with new onset of seizures in the emergency department. *Epilepsia* 2000; 41(8):950-954.

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Wachtel RE, Dexter F, Dow AJ. Growth rates in pediatric diagnostic imaging and sedation. *Anesth Analg* 2009; 108(5):1616-1621.

Warden CR, Brownstein DR, DelBeccaro MA. Predictors of abnormal findings on computed tomography of the head in pediatric patients presenting with seizures. *Ann Emerg Med* 1997; 29(4):518-523.

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 specifications document, *Q-METRIC Overuse of Imaging Measure 9, Overuse of Computed Tomography Scans for the Evaluation of Children with a First Generalized Afebrile, Atraumatic Seizure*, 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).

Importance

Afebrile, Atraumatic Seizures: Prevalence and Incidence

The American Academy of Neurology Practice Parameter: Evaluating a First Nonfebrile Seizure in Children estimates that annually, between 25,000 and 40,000 children in the United States

experience a first nonfebrile seizure (Hirtz et al., 2000; Hirtz et al., 2003). Seizures account for roughly 2% of visits to emergency departments at children's hospitals (Martindale et al., 2011).

Afebrile, Atraumatic Seizure Pathology and Severity

In general, a seizure will involve abnormal movements or changes in behavior that occur as a result of uncontrolled electrical activity in the brain (Duvivier and Pollack, 2009). A generalized seizure is associated with altered consciousness because abnormal electrical activity involves all or large parts of the brain. The expected overall recurrence rate after a first unprovoked seizure is around 50%, with a minority of children going on to experience multiple recurrent seizures (Hirtz et al., 2003).

Burdens of Overuse of Imaging in Afebrile, Atraumatic Seizures

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.

Radiation-Related Burden and Risk

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 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 American College of Radiology (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 risks, though rare, include brain damage and death (Society for Pediatric Anesthesia, 2014).

Intravenous Contrast-Related Burden and Risk

During the course of CT and MRI 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

The low yield of neuroimaging studies in children with seizure presenting to emergency departments has been documented repeatedly (Warden et al., 1997; Garvey et al., 1998; Hirtz et al., 2000; Maytal et al.,2000; Gaillard et al., 2009; Aprahamian et al., 2014). The AAN, the International League Against Epilepsy (ILAE), and the ACR generally favor MRI over CT for the evaluation of children who require neuroimaging after a first afebrile seizure, due to the superior resolution and lack of radiation associated with MRI (Hirtz et al., 2000; Gaillard et al., 2009; ACR Expert Panel on Pediatric Imaging, Dory et al., 2012). The AAN and ILAE also provide guidance on specific features of childhood seizures that increase or decrease the likely benefit of obtaining neuroimaging studies at all (Gaillard et al., 2009; Hirtz et al., 2000).

This measure assesses the percentage of children, ages 1 through 17 years old, for whom CT imaging of the head is obtained for the evaluation of a first generalized afebrile, atraumatic seizure without indication for CT imaging.

A lower percentage indicates better performance, as reflected by avoiding CT imaging when it is not indicated.

Drivers of Overuse

Seizures can be stressful events that may prompt a parent to seek the assistance of a health care provider, at times emergently. A seizure generates considerable distress and concern for family members and caregivers who witness it (Shinnar and Pellock, 2002; Baumer et al., 1981). Some providers may feel pressured by the parent to order imaging despite a lack of benefit (ACR Expert Panel on Pediatric Imaging, Dory et al., 2012). This circumstance has a close parallel with parents who seek antibiotics for a 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 about the risks and benefits of CT imaging continues to be a key feature of minimizing overuse in the setting of seizures.

The practice of defensive medicine is another reason an imaging study may be ordered. Physicians may be uncomfortable facing uncertainty regarding the etiology of seizure 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).

Afebrile, Atraumatic Seizure 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 who both experience seizures and have Medicaid or CHIP, curtailing the overuse of imaging will favorably reduce radiation exposure, poor sedation or anesthesia 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 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 afebrile, atraumatic seizures.

References for Section III:

American Academy of Pediatrics (AAP). Choosing Wisely: An initiative of the ABIM Foundation. Ten Things Physicians and Patients Should Question. 2013. Available at: http://www.choosingwisely.org/doctor-patient-lists/american-academy-of-pediatrics/; accessed: February 24, 2015.

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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.

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Wachtel RE, Dexter F, Dow AJ. Growth rates in pediatric diagnostic imaging and sedation. *Anesth Analg* 2009; 108(5):1616-1621.

Warden CR, Brownstein DR, DelBeccaro MA. Predictors of abnormal findings on computed tomography of the head in pediatric patients presenting with seizures. *Ann Emerg Med* 1997; 29(4):518-523.

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	**No**	
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	**No**	
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**	All ages in this range
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**	Ages 11 through 17 years (i.e., younger than 18)

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 percentage of children, ages 1 through 17 years old, for whom CT imaging of the head is obtained for the evaluation of a first generalized afebrile, atraumatic seizure without indication for CT imaging. A number of evidence-based reviews have concluded that emergent neuroimaging of a child who has experienced an afebrile, atraumatic (unprovoked seizure) is not indicated. In its Practice Parameter regarding first nonfebrile seizure in children, the AAN recommends MRI as the preferred modality if a neuroimaging study is obtained (Hirtz et al., 2000). The AAN also recommends that emergent neuroimaging be obtained in children who have not returned to baseline within several hours after a seizure. Similarly, the ILAE supports the use of MRI for the imaging of children with seizure, while acknowledging CT is more widely available than MRI and less likely to require sedation for younger children (Gaillard et al., 2009). The low yield of neuroimaging studies in children with seizure presenting to emergency departments has been documented repeatedly (Aprahamian et al., 2004; Gaillard et al., 2009; Garvey et al., 1998; Hirtz et al., 2000; Maytal et al., 2000; Warden et al., 1997). In a retrospective chart review of 500 children with new-onset afebrile seizures, Sharma and colleagues (Sharma et al., 2003) found few clinically significant abnormal findings on neuroimaging. They concluded that children who meet low-risk criteria can be safely discharged from the emergency department, if follow-up can be assured, without emergent neuroimaging.

Table 10 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 seizure (Figures 1 and 2).

Table 10: Evidence Regarding Overuse of Imaging for the Evaluation of Children with Afebrile, Atraumatic Seizures

Type of Evidence	Key Findings	Level of Evidence (USPSTF Ranking*)	Citations
Evidence-based review	Members of the Quality Standards Subcommittee of the American Academy of Neurology conducted an evidence-based review of the literature to develop practice parameters for evaluation of children with first nonfebrile seizure. They found few CT studies of children with first nonfebrile seizure have abnormalities that require intervention (0 to 7%). The yield of CT scans to identify an abnormality when the neurologic examination and EEG were normal was 5% to 10%. Up to one-third of children who underwent MRI in one class I study had an abnormality, none required intervention. In another class I study of children with newly diagnosed epilepsy, 86% had neuroimaging and none had abnormalities that required immediate treatment. Emergent neuroimaging was recommended in children who exhibit post-ictal deficit not quickly resolving, or who have not returned to baseline within several hours after the seizure.	II	Hirtz D, Ashwal S, Berg A, et al. Practice parameter: Evaluating a first nonfebrile seizure in children: Report of the quality standards subcommittee of the American Academy of Neurology, The Child Neurology Society and the American Epilepsy Society. *Neurology* 2000; 55(5):616-623.
Clinical guideline	International League Against Epilepsy (ILAE) guidelines for neuroimaging studies in the evaluation of children with recent-onset epilepsy acknowledge that neuroimaging is important in the initial evaluation and management to detect structural lesions related to the seizure disorder. They also outline situations where imaging may not be necessary, including idiopathic focal or generalized epilepsy. When available, MRI is preferred to CT because of its superior resolution, versatility, and lack of radiation. However, CT is more widely available than MRI, is less expensive, and less likely to require sedation for younger patients.	III	Gaillard WD, Chiron C, Cross JH et al. Guidelines for imaging infants and children with recent-onset epilepsy. *Epilepsia* 2009; 50(9):2147-2153.

Type of Evidence	Key Findings	Level of Evidence (USPSTF Ranking*)	Citations
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 atraumatic seizures usually do not require imaging evaluation with CT. MRI is preferred, as it provides greater detail of brain structures. There is added benefit in that MRI does not use ionizing radiation.	III	American College of Radiology (ACR) Expert Panel on Pediatric Imaging: Dory CE, Coley BD, Karmazyn B, et al. ACR Appropriateness Criteria: Seizures —Child. American College of Radiology, revised 2012. Available at: http://www.acr.org/Quality-Safety/Appropriateness-Criteria/Diagnostic/~/media/ACR/Documents/AppCriteria/Diagnostic/SeizuresChild.pdf; accessed July 16, 2015.
Retrospective study	This was a retrospective review of children presenting to a single emergency department between July 1993 and June 1994 who underwent a CT for evaluation of a first seizure. Of 99 children with a CT scan obtained, 19 had brain abnormalities. Of the 19 children with abnormal CT findings, seven required further investigation or treatment. In the 6 months after the CT scan, 33 children had an MRI. MRI findings were identical to CT scan findings in 18.	III	Garvey MA, Gaillard WD, Rusin JA, et al. Emergency brain computed tomography in children with seizures: Who is most likely to benefit? *J Pediatr* 1998; 133(5):664-669.
Retrospective study	This was a retrospective cross sectional study of 319 pediatric patients presenting between October 1995 and March 2012 to an urban pediatric tertiary care emergency department who underwent neuroimaging within 24 hours for evaluation of a first-time non-febrile seizure with focal manifestations. Emergent CT was obtained in 262 children, both CT and MRI were obtained in 42, and MRI alone was obtained in 15. Only 13 children had a finding of clinically urgent intracranial pathology. Sixty two percent of the cases (n=163) underwent subsequent MRI within 72 hours of presentation. Of the 252 children whose initial emergent imaging study was a CT scan, 81% (n=205) underwent delayed MRI. Of	III	Aprahamian N, Harper MB, Prabhu SP. Pediatric first time non-febrile seizure with focal manifestations: Is emergent imaging indicated? *Seizure* 2014; 23(9):740-745.

Type of Evidence	Key Findings	Level of Evidence (USPSTF Ranking*)	Citations
	these 28% (58/205) had an abnormal finding. Among children with an abnormal finding on delayed MRI, 29% (17/58) were not identified on initial CT scan.		
Retrospective study	This was a retrospective review of 66 pediatric patients presenting during the 1995 calendar year to a children's hospital emergency department who underwent a CT scan prior to ED discharge for evaluation of a first seizure. Abnormal CT findings were present in 14 children (21%). Twenty patients also underwent MRI, two of whom were noted to have a discrepancy between CT and MRI findings. One patient had a normal CT with an abnormal MRI, the other patient had an abnormal CT and a normal MRI.	III	Maytal J, Krauss JM, Novak G et al. The role of brain computed tomography in evaluating children with new onset of seizures in the emergency department. *Epilepsia* 2000; 41(8):950-954.
Retrospective study	This was a retrospective case series of 203 children who presented from January 1992 to December 1994 to the emergency department of a tertiary care children's hospital who underwent head CT as a part of an emergency department evaluation for seizure. Head CT findings were abnormal in 25 patients (12%).	II	Warden CR, Brownstein DR, DelBeccaro MA. Predictors of abnormal findings on computed tomography of the head in pediatric patients presenting with seizures. *Ann Emerg Med* 1997; 29(4):518-523.
Retrospective study	Five hundred consecutive cases of new-onset atraumatic seizures as seen in the emergency department of a tertiary care children's hospital between October 1996 and July 1998 were reviewed. Neuroimaging was obtained in 95% and CT was the initial study performed in 91%. Nearly all (92%) of subjects underwent neuroimaging while in the ED and 5% underwent neuroimaging more than 72 hours after the ED visit. Most children had normal neuroimaging results (83%), with 9% having clinical insignificant findings and 8% having clinically significant abnormalities. Trauma and vascular and structural lesions were the most common findings among children with clinically significant abnormalities.	III	Sharma S, Riviello JJ, Harper MB, Baskin MM. The role of emergent neuroimaging in children with new-onset afebrile seizures. *Pediatrics* 2003;111(1):1-5.

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

Date of origin: 1995
Last review date: 2012

American College of Radiology
ACR Appropriateness Criteria®

Clinical Condition: **Seizures — Child**

Clinical Condition: **Seizures — Child**

Variant 6: **First generalized seizure (neurologically normal).**

Radiologic Procedure	Rating	Comments	RRL*
MRI head without contrast	5		O
MRI head without and with contrast	4	See statement regarding contrast in text under "Anticipated Exceptions."	O
CT head without contrast	4		☢☢☢
CT head without and with contrast	2		☢☢☢☢
CT head with contrast	2		☢☢☢
SPECT head	1		☢☢☢
FDG-PET/CT head	1		☢☢☢☢
US head	1		O
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 (ACR) Expert Panel on Pediatric Imaging: Dory CE, Coley BD, Karmazyn B, et al. ACR Appropriateness Criteria: Seizures—Child. American College of Radiology, revised 2012. Available at: http://www.acr.org/Quality-Safety/Appropriateness-Criteria/Diagnostic/~/media/ACR/Documents/AppCriteria/Diagnostic/SeizuresChild.pdf. Accessed May 15, 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.

This measure was tested using inter-rater reliability (IRR) of medical record data, as described below.

Abstracted Medical Record Data

Medical record data were obtained through HealthCore, Inc., an independent subsidiary of Anthem, Inc., the largest health benefits company/insurer in the United States. HealthCore owns and operates the HealthCore Integrated Research Database (HIRD), a longitudinal database of medical and pharmacy claims and enrollment information for members from 14 geographically diverse Blue Cross and/or Blue Shield (BCBS) health plans in the Northeast, South, West, and Central regions of the United States, with members living in all 50 states. The HIRD includes automated computerized claims data and enrollment information for approximately 60 million lives with medical enrollment, over 37 million lives with combined medical and pharmacy enrollment information, and 16 million lives with outpatient laboratory data from the BCBS licensed plans.

This measure belongs to the Q-METRIC Overuse of Imaging for the Evaluation of Children with Headache or Seizures measures collection. As part of the initial sampling strategy for testing multiple measures in this collection, approximately 2.1 million children, ages 6 months through 17 years old, were identified in the HIRD for the study's 2012 measurement year. Of these, a cohort of children with diagnosis codes for headaches and seizures were identified (57,748). Members who did not have continuous eligibility during the 2011 and 2012 calendar years were excluded, narrowing the group to 36,985. Specifically for this measure, administrative claims were used to identify children, ages 1 through 17 years old, who were diagnosed with a first generalized afebrile, atraumatic seizure (4,385, 11.9%). From this group, 532 children (12.1%) were identified as having CT imaging. After applying claims denominator exclusions, 296 children (55.6%) remained eligible for medical record review.

Among the children eligible for the denominator based on claims, providers associated with the eligible children's visits were identified; the final sampling population consisted of 218 children (73.6%) who were linked to a provider with available contact information. Once subjects were

identified, patient medical records were requested from health care providers; records were sent to a centralized location for data abstraction. To ensure an adequate number of cases to test the feasibility of this measure, we set a target sample of 200 abstracted charts.

Trained medical record abstractors reviewed paper copies of the medical records and entered data collected into a password-protected database. To help ensure consistency of data collection, the medical record abstractors were trained on the study's design and presented with a standardized data collection form designed to minimize the need to make subjective judgments during the abstraction process. In addition, data were entered onto forms, which were subsequently scanned and reviewed through a series of quality checks.

Although 200 charts were requested for the target sample, a total of 89 charts were obtained from provider offices and health care facilities. These charts were reviewed for the presence of denominator exclusions that were not present in claims. There were 33 children (37.1%) with documentation of a condition that met denominator exclusion within the chart, resulting in a total of 56 children (62.9%) who met denominator criteria for this measure. Among patients eligible for the denominator, CT imaging was obtained without a documented indication for 44 children (78.6%).

Inter-Rater Reliability

Reliability of medical record data was determined through re-abstraction of patient record data to calculate the IRR between abstractors. Broadly, IRR is the extent to which the abstracted information is collected in a consistent manner. Low IRR may be a sign of poorly executed abstraction procedures, such as ambiguous wording in the data collection tool, inadequate abstractor training, or abstractor fatigue. For this measure, the medical record data collected by three abstractors was individually compared with the data obtained by a senior abstractor. IRR was determined by calculating both percent agreement and Cohen's kappa statistic.

Of the 89 medical records received for chart review, 13 records (14.6%) were reviewed for IRR. IRR was assessed by comparing the abstractor agreement with a senior abstractor on 16 questions included in the chart abstraction form for this measure. Overall, abstractor agreement was 100%; the kappa statistic was 1.0, indicating a perfect level of agreement was achieved. Given this evidence, the data elements needed for calculation of the measure can be abstracted from medical records with a high degree of accuracy.

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 headaches or 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 the appropriate imaging of children. Concepts and draft measures were rated by this group for their relative importance. This measure received an average score of 7.6 (with 9 as the highest possible score).

Validity of Exclusion Criteria

Denominator: We tested the validity of administrative claims to exclude cases from the denominator based on the following exclusions that could be identified using ICD-9-CM or CPT codes: partial seizure; fever; complex febrile seizure; post-traumatic seizure; trauma such as skull fracture, concussion, intracranial hemorrhage and suspected abuse and neglect; developmental delay, lack of expected normal physiological development or delayed milestone; pre-existing conditions that would warrant imaging such as neoplasm and blood disorder, hydrocephalus and CNS anomalies, hemangioma, phlebitis/ thrombophlebitis, occlusion of cerebral arteries, moyamoya disease, tumor, hemorrhage, or tuberous sclerosis; infection such as meningitis, brain abscess, HIV and encephalitis, lumbar puncture; and neurological surgery. Children with codes associated with these claims-based exclusions were removed from the chart review sample. In other words, none of the charts sampled for medical record review had administrative claims that contained ICD-9-CM or CPT codes associated with these conditions. We tested the accuracy of the assumption that the absence of these codes in administrative claims would mean the absence of clinical documentation indicative of these exclusionary conditions in the medical record.

Of the 89 charts that were reviewed, 33 (37.1%) were excluded based on clinical documentation within the medical record of one of the denominator exclusions listed above. Therefore, 56 (62.9%) were in agreement with the administrative claims regarding the absence of these denominator exclusions. These results demonstrate that a substantial number of additional children were excluded from the denominator based on information only available through chart review. Therefore, although the use of administrative claims is an appropriate and valid method to narrow the population of charts sampled within this measure specification, the presence of these exclusionary conditions in the medical record indicates that medical record abstraction is necessary to accurately identify denominator exclusions with confidence.

Numerator: We tested the potential to exclude cases from the numerator using administrative claims by comparing information abstracted from the medical record with ICD-9-CM or CPT codes for the following two numerator exclusions:

- Status epilepticus (Table 2 [=IMG2]) on the day of or within the 365 days before imaging was obtained.
- Signs or symptoms of increased intracranial pressure (Table 11 [= IMG11]) on the day of or day before imaging was obtained.

For this comparison, the medical chart was considered the gold standard. Sensitivity, specificity, and negative and positive predictive values were calculated.

Note that the other two numerator exclusions (notably different mental state when compared with prior exams and abnormal neurologic exam findings) must be identified using information abstracted from the medical chart (i.e., these exclusions cannot be determined from claims data). See Numerator Exclusions in Section I for more detail.

Among children eligible for the denominator after chart review (n=56), the sensitivity of claims for identification of status epilepticus was (0/3) = 0%; the specificity was (53/53) = 100%; the positive predictive value (PPV) was (0/0) = 0%; and the negative predictive value (NPV) was (53/56) = 95% (Table 12). The sensitivity of claims for identification of signs or symptoms of increased intracranial pressure was (0/1) = 0%; the specificity was (44/55) = 80%; the PPV was (0/11) = 0%; and the NPV was (44/45) = 98% (Table 13). Our results indicate that chart review is necessary for accurate and complete collection of numerator exclusion criteria.

Table 12: Contingency Table for Presence of Status Epilepticus in Administrative Claims and Charts

		Status Epilepticus Based on Chart Review		
		Present	Absent	Total
Status epilepticus based on ICD-9-CM codes	Present	0	0	0
	Absent	3	53	56
	Total	3	53	56

Table 13: Contingency Table for Presence of Signs or Symptoms of Increased Intracranial Pressure in Administrative Claims and Charts

		Signs or Symptoms of Increased Intracranial Pressure Based on Chart Review		
		Present	Absent	Total
Signs or symptoms of increased intracranial pressure based on ICD-9-CM codes	Present	0	11	11
	Absent	1	44	45
	Total	1	55	56

The Importance of Abstracted Medical Record Data

This measure is specified using medical record data after administrative claims are used to identify the eligible population. Medical records are considered the gold standard for clinical information; our findings indicate that these data have a high degree of face validity and reliability, as summarized above. As several key numerator exclusions cannot be applied using claims alone, our findings indicate that it is necessary to identify exclusion criteria for this measure within medical records in order to accurately assess the overuse of CT for children with a first generalized afebrile, atraumatic seizure. For example, there are no ICD-9-CM codes to indicate that the child is exhibiting a notably

different mental state compared with prior exams. Further evidence for the necessity of medical charts can be seen in our data, where an additional 37% of cases that would have been included using administrative claims only were excluded from the denominator once chart review was performed. As a consequence, implementing this measure solely upon administrative claims data would tend to overstate the degree of overuse of imaging among this population.

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

Census Characteristics

Race and ethnicity were generally unavailable from the medical records reviewed for this study. However, overall race and ethnicity characteristics of the ZIP codes in which sampled children live can be summarized using demographic characteristics collected for the 2010 United States Census (US Census Bureau, 2010). The summary statistics for race and ethnicity within ZIP code for sampled groups of children with valid ZIP codes are reported in Tables 14 and 15.

Overall, the proportion of residents in specific racial groups was similar in all groups of sampled children. On average, sampled children reside in ZIP codes reporting primarily white race (range: 78.2%-82.5%) and within ZIP codes reporting modest levels of Hispanic ethnicity (8.7%-11.2%).

Table 14. Mean (Standard Deviation) Proportion in Racial Groups within Sampled ZIP Codes of Residence‡

Sampled Group Description	American Indian or Alaska Native Mean (SD)‡	Asian Mean (SD)‡	Black or African American Mean (SD)‡	Native Hawaiian or Other Pacific Islander Mean (SD)‡	White Mean (SD)‡	Two or More Races Mean (SD)‡	Other Mean (SD)‡
Eligible children with first generalized afebrile, atraumatic seizure (n=4,291)*	0.5 (1.3)	5.7 (8.6)	8.2 (13.2)	0.1 (0.4)	78.6 (17.9)	2.7 (1.6)	4.2 (6.3)
Subset who had CT imaging (n=522)**	0.5 (1.4)	5.5 (8.8)	8.5 (13.2)	0.1 (0.5)	78.2 (17.8)	2.8 (2.0)	4.3 (6.6)
Subset following claims denominator exclusions (n=293)***	0.6 (1.8)	4.3 (7.0)	7.9 (12.1)	0.1 (0.3)	80.6 (15.7)	2.6 (1.5)	4.0 (5.8)
Subset following claims numerator exclusions (n=243)****	0.6 (2.0)	4.3 (7.4)	8.3 (12.6)	0.1 (0.3)	80.2 (16.3)	2.6 (1.5)	3.9 (5.5)
Subset with abstracted medical	0.5 (0.5)	4.1 (6.9)	8.4 (12.1)	0.1 (0.1)	81.0 (14.0)	2.5 (1.4)	3.3 (5.2)

Sampled Group Description	American Indian or Alaska Native Mean (SD)‡	Asian Mean (SD)‡	Black or African American Mean (SD)‡	Native Hawaiian or Other Pacific Islander Mean (SD)‡	White Mean (SD)‡	Two or More Races Mean (SD)‡	Other Mean (SD)‡
records (n=88)+							
Subset meeting denominator criteria (n=55)++	0.5 (0.5)	4.3 (7.4)	7.4 (11.0)	0.1 (0.1)	81.7 (13.7)	2.6 (1.5)	3.4 (5.6)
Subset meeting numerator criteria (n=43) +++	0.5 (0.6)	3.8 (6.7)	7.3 (11.7)	0.1 (0.1)	82.5 (13.6)	2.6 (1.5)	3.2 (4.2)

‡Data summarize characteristics of the broader population residing in ZIP codes of sampled cases.
*Among eligible children who had a first afebrile, atraumatic seizure (n=4,385), no information available for 94 members (2.1%) due to missing or unmatched ZIP code, yielding n=4,291 (97.9%).
** Among the subset of children who had CT imaging (n=532), no information available for 10 members (1.9%) due to missing or unmatched ZIP code, yielding n=522 (98.1%).
*** Among the subset of children following claims denominator exclusions (n=296), no information available for 3 members (1.0%) due to missing or unmatched ZIP code, yielding n=293 (99.0%).
**** Among the subset of children following claims numerator exclusions (n=245), no information available for 2 members (0.8%) due to missing or unmatched ZIP code, yielding n=243 (99.2%).
+ Among the subset of children with abstracted medical records (n=89), no information available for 1 member (1.1%) due to missing or unmatched ZIP code, yielding n=88 (98.9%).
++ Among the subset of children meeting denominator criteria (n=56), no information available for 1 member (1.8%) due to missing or unmatched ZIP code, yielding n=55 (98.2%).
+++ Among the subset of children meeting numerator criteria (n=44), no information available for 1 member (2.3%) due to missing or unmatched ZIP code, yielding n=43 (97.7%).

Table 15. Mean (Standard Deviation) Proportion Reporting Hispanic Ethnicity within Sampled ZIP Codes of Residence‡

Sampled Group Description	Hispanic Ethnicity Mean (SD) ‡
Eligible children with first generalized afebrile, atraumatic seizure (n=4,291)*	10.8 (14.0)
Subset who had CT imaging (n=522)**	11.2 (15.1)
Subset following claims denominator exclusions (n=293)***	10.5 (14.5)
Subset following claims numerator exclusions (n=243)****	10.1 (13.4)
Subset with abstracted medical records (n=88)+	9.1 (13.5)
Subset meeting denominator criteria (n=55)++	9.7 (14.8)
Subset meeting numerator criteria (n=43)+++	8.7 (9.4)

‡Data summarize characteristics of the broader population residing in ZIP codes of sampled cases.
*Among eligible children who had a first afebrile, atraumatic seizure (n=4,385), no information available for 94 members (2.1%) due to missing or unmatched ZIP code, yielding n=4,291 (97.9%).
** Among the subset of children who had CT imaging (n=532), no information available for 10 members (1.9%) due to missing or unmatched ZIP code, yielding n=522 (98.1%).
*** Among the subset of children following claims denominator exclusions (n=296), no information available for 3 members (1.0%) due to missing or unmatched ZIP code, yielding n=293 (99.0%).
**** Among the subset of children following claims numerator exclusions (n=245), no information available for 2 members (0.8%) due to missing or unmatched ZIP code, yielding n=243 (99.2%).
+ Among the subset of children with abstracted medical records (n=89), no information available for 1 member (1.1%) due to missing or unmatched ZIP code, yielding n=88 (98.9%).

++ Among the subset of children meeting denominator criteria (n=56), no information available for 1 member (1.8%) due to missing or unmatched ZIP code, yielding n=55 (98.2%).
+++ Among the subset of children meeting numerator criteria (n=44), no information available for 1 member (2.3%) due to missing or unmatched ZIP code, yielding n=43 (97.7%).

VII.B. Special Health Care Needs

The medical records data abstracted for this study do not include indicators of special health care needs.

VII.C. Socioeconomic Status

Census Characteristics

Socioeconomic status was not available from the medical records reviewed for this study. However, the overall median household income of the ZIP codes in which sampled children live can be summarized using demographic characteristics collected for the 2011 American Community Survey (ACS) (US Census Bureau, 2013). The summary statistics for median household income within ZIP code for sampled groups of children with valid ZIP codes and complete census data are reported in Table 16.

Overall, the ZIP code-level median household income for groups of sampled children ranged from $62,388-$66,597, with the exception of the largest pool of candidates, children with first generalized afebrile, atraumatic seizure, which was slightly higher ($70,000).

Table 16. Median Household Income within Sampled ZIP Codes of Residence‡

Sampled Group Description	Median Household Income (Mean)‡	SD	Min	25th Percentile	Median	75th Percentile	Max
Eligible children with first generalized afebrile, atraumatic seizure (n=4,288)*	$70,000	$29,062	$10,625	$47,741	$64,443	$86,224	$218,214
Subset who had CT imaging (n=522)**	$66,597	$28,981	$24,260	$44,299	$59,462	$82,679	$191,200
Subset following claims denominator exclusions (n=293)***	$65,528	$26,650	$25,560	$44,628	$59,879	$78,851	$164,388
Subset following claims numerator exclusions (n=243)****	$65,011	$26,429	$25,560	$44,571	$59,718	$77,520	$164,388
Subset with abstracted medical records (n=88)+	$63,567	$25,803	$27,311	$44,384	$57,273	$74,894	$159,464
Subset meeting denominator criteria (n=55)++	$65,971	$28,402	$30,859	$43,416	$63,763	$78,438	$159,464

Sampled Group Description	Median Household Income (Mean)‡	SD	Min	25th Percentile	Median	75th Percentile	Max
Subset meeting numerator criteria (n=43)+++	$62,388	$24,073	$30,859	$43,416	$57,668	$73,738	$127,188

‡Data summarize characteristics of the broader population residing in ZIP codes of sampled cases.
*Among eligible children who had a first afebrile, atraumatic seizure (n=4,385), no information available for 97 members (2.2%) due to missing or unmatched ZIP code or missing census data, yielding n=4,288 (97.8%)
** Among the subset of children who had CT imaging (n=532), no information available for 10 members (1.9%) due to missing or unmatched ZIP code or missing census data, yielding n=522 (98.1%).
*** Among the subset of children following claims denominator exclusions (n=296), no information available for 3 members (1.0%) due to missing or unmatched ZIP code or missing census data, yielding n=293 (99.0%).
**** Among the subset of children following claims numerator exclusions (n=245), no information available for 2 members (0.8%) due to missing or unmatched ZIP code or missing census data, yielding n=243 (99.2%).
+ Among the subset of children with abstracted medical records (n=89), no information available for 1 member (1.1%) due to missing or unmatched ZIP code or missing census data, yielding n=88 (98.9%).
++ Among the subset of children meeting denominator criteria (n=56), no information available for 1 member (1.8%) due to missing or unmatched ZIP code or missing census data, yielding n=55 (98.2%).
+++ Among the subset of children meeting numerator criteria (n=44), no information available for 1 member (2.3%) due to missing or unmatched ZIP code, yielding n=43 (97.7%).

VII.D. Rurality/Urbanicity

Census Characteristics

Urbanicity was not available from the medical records reviewed for this study. However, urbanicity of the ZIP codes in which sampled children live can be summarized using demographic characteristics collected for the 2010 United States Census, (US Census Bureau, 2010). The summary statistics for urbanicity within ZIP code for sampled groups of children with valid ZIP codes are in Table 17.

Overall, the ZIP codes of all groups of sampled children were largely categorized as being urban (74.3%-79.3%).

Table 17. Proportion of Sampled ZIP Codes Categorized as Urban‡

Sampled Group Description	Urban (Mean)‡	SD	Min	25th Percentile	Median	75th Percentile	Max
First generalized afebrile, atraumatic seizure (n=4,291)*	79.3	31.8	0	72.0	96.6	100	100
CT imaging (n=522)**	77.2	32.7	0	69.7	93.9	100	100
Subset following claims denominator exclusions (n=293)***	75.4	33.5	0	66.4	92.5	99.9	100
Subset following claims numerator exclusions (n=243)****	75.6	33.3	0	66.9	91.5	100	100
Reviewed and	74.3	32.3	0	68.6	87.4	97.4	100

Sampled Group Description	Urban (Mean)‡	SD	Min	25th Percentile	Median	75th Percentile	Max
abstracted medical records (n=88)+							
Children meeting denominator criteria (n=55)++	76.2	31.3	0	74.7	87.6	97.5	100
Children meeting numerator criteria (n=43)+++	75.8	32.8	0	74.7	89.7	97.6	100

‡Data summarize characteristics of the broader population residing in ZIP codes of sampled cases.
*Among eligible children who had a first afebrile, atraumatic seizure (n=4,385), no information available for 94 members (2.1%) due to missing or unmatched ZIP code, yielding n=4,291 (97.9%).
** Among the subset of children who had CT imaging (n=532), no information available for 10 members (1.9%) due to missing or unmatched ZIP code, yielding n=522 (98.1%).
*** Among the subset of children following claims denominator exclusions (n=296), no information available for 3 members (1.0%) due to missing or unmatched ZIP code, yielding n=293 (99.0%).
**** Among the subset of children following claims numerator exclusions (n=245), no information available for 2 members (0.8%) due to missing or unmatched ZIP code, yielding n=243 (99.2%).
+ Among the subset of children with abstracted medical records (n=89), no information available for 1 member (1.1%) due to missing or unmatched ZIP code, yielding n=88 (98.9%).
++ Among the subset of children meeting denominator criteria (n=56), no information available for 1 member (1.8%) due to missing or unmatched ZIP code, yielding n=55 (98.2%).
+++ Among the subset of children meeting numerator criteria (n=44), no information available for 1 member (2.3%) due to missing or unmatched ZIP code, yielding n=43 (97.7%).

VII.E. Limited English Proficiency (LEP) Populations

The medical records data abstracted for this study do not include indicators of LEP.

References for Section VII

US Census Bureau. 2011 American Community Survey (ACS). 2013. Available at: http://www.census.gov/acs/www/data_documentation/2011_release; accessed March 9, 2015.

US Census Bureau. 2010 United States Census. 2010. Available at: http://www.census.gov/2010census/; accessed March 9, 2015.

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 data to identify the eligible population for medical record review. Administrative data needed for this measure include date of birth, diagnosis codes, 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.

Testing this measure using medical record data required the development of an abstraction tool and the use of qualified nurse abstractors. Review of clinical documentation was required to ensure that exclusions were appropriately captured for the determination of overuse of neuroimaging (i.e., status epilepticus, signs of increased intracranial pressure, notably different mental state compared with previous exams, and abnormal neurological exam).

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 neuroimaging has been overused in the evaluation of children experiencing a first generalized afebrile, atraumatic seizure.

In addition, the use of ICD-10-CM codes is now required. For ease of future implementation, the ICD-9-CM codes used in this measure have been converted to ICD-10-CM using the Centers for Medicare

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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.

and Medicaid Services (CMS) 2015 diagnosis code General Equivalence Mappings (GEM) and diagnosis code description files, accessed on August 26, 2015. The ICD-9-CM codes were converted to ICD-10-CM using the GEM file and manually reviewed for consistency using the diagnosis code descriptions for the source ICD-9-CM and converted ICD-10-CM codes. In addition, the resultant ICD-10-CM codes were back-translated to ICD-9-CM to verify the accuracy of the coding. Source files from CMS were acquired from these files:

1. ICD-9 to 10 diagnosis GEM -*2015_I9gem.txt*
   https://www.cms.gov/Medicare/Coding/ICD10/2015-ICD-10-CM-and-GEMs.html
2. ICD-10 to 9 diagnosis GEM - 2015_10gem.txt
   https://www.cms.gov/Medicare/Coding/ICD10/2015-ICD-10-CM-and-GEMs.html
3. ICD-9 description file - *CMS32_DESC_SHORT_DX.txt*
   https://www.cms.gov/Medicare/Coding/ICD9ProviderDiagnosticCodes/codes.html
4. ICD-10 description file - *icd10cm_order_2015.txt*
   https://www.cms.gov/Medicare/Coding/ICD10/2015-ICD-10-CM-and-GEMs.html

The resultant ICD-10-CM codes were clinically reviewed; the final set of ICD-10-CM codes can be found in the Appendix. Note that E-codes were not converted due to technical issues with translation. ICD-9-CM procedure codes for head CT and brain MRI were converted using an online tool: http://www.icd10data.com/Convert.

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, primary care case management, FFS, and other models)	☐Yes ☒No	NA	NA	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?
Health plan*: Can compare quality of care among health plans.	☒Yes ☐No	This measure requires medical record abstraction; medical records are maintained by all health services providers. Target population for sampling requires administrative claims data to identify subgroups of potentially eligible cases for medical record review.	Availability of medical records meeting inclusion criteria will vary by plan. A minimum of approximately 200 abstracted charts for eligible children during the measurement year is recommended. Our results indicate that among 4,385 members between 1 and 17 years of age with 2 years of continuous eligibility and a diagnosis of a first generalized afebrile, atraumatic seizure, 296 (6.8%) were eligible for medical record review. Among 89 sampled charts, we found that 56 (63%) met denominator criteria. From these findings, we estimate that (6.8% * 63%) = 4.3% of our test population have denominator-eligible charts. Based on these results, we estimate that to obtain a target of 200 denominator-eligible charts, approximately (200/0.043) = approximately 4,650 children between the ages of 1 and 17 years with diagnosis codes for first generalized afebrile, atraumatic seizure would be required to meet this target.	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?
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 medical record abstraction; medical records are maintained by all health services providers.	This measure has not been tested at the hospital level; consequently, the minimum number of patients per hospital has not been determined.	NA	NA	NA
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 a first generalized afebrile, atraumatic seizure. 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 a first, afebrile, atraumatic seizure. The primary information needed for this measure is sourced from medical records and 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

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 also can provide education about alternatives to imaging. Alerts and reminders, given to patients as well as providers, might also enhance use of the measure.

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.

Our results indicate that these data are already recorded in EHR systems. Order entry systems can provide structured information about orders placed for neuroimaging studies; this furnishes key information necessary for the measure. However, important information required for numerator or denominator exclusion criteria may be recorded in an unstructured format in problem lists, as well as in nursing and physician notes. For this measure to be accurate, it may be necessary to combine data from multiple EHR systems. The use of Health Information Exchange (HIE), especially using the DIRECT protocol for exchange across individual electronic medical records (EMRs), would be an important tactical step to enable this 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

The ONC's Health IT Standards explicitly address the receipt of CT and MR imaging results and other diagnostic tests into EHRs, which may be relevant in hospitals providing imaging services to children. 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, which provide evidence that ordered imaging studies were completed. 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 and MR 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 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. In 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 neuroimaging is not indicated. Information buttons could link to educational resources at the point of care to discourage unnecessary ordering, as well, 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 Standards

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 percentage of children, ages 1 through 17 years old, for whom CT imaging of the head is obtained for the evaluation of a first generalized afebrile, atraumatic seizure without indication for CT imaging. For the purposes of this measure, indications for CT imaging include status epilepticus, signs of increased intracranial pressure, notably different mental state compared with prior exams, or an abnormal neurologic exam. A lower percentage indicates better performance, as reflected by avoiding CT imaging when it is not indicated.

The following considerations may further strengthen this measure and potentially ease the burden of data collection. Some denominator exclusions cannot be reliably identified using administrative claims. This leads us to conclude that this measure cannot reliably be implemented using administrative data alone; doing so would result in miscalculation of the degree to which CT imaging is overused for the evaluation of children with a first generalized afebrile, atraumatic seizure. Many of the neurologic signs and symptoms that suggest intracranial pathology are only captured in the clinical documentation contained within the medical record. 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. This would allow for electronic capture of clinical information needed to determine if and when neuroimaging has been overused in the evaluation of children experiencing a first generalized afebrile, atraumatic seizure.

In future implementation, we recommend considering the inclusion of the *ordering* of neuroimaging studies in this measure 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 percentage of children, ages 1 through 17 years old, for whom CT imaging of the head is obtained for the evaluation of a first generalized afebrile, atraumatic seizure without indication for CT imaging. For the purposes of this measure, indications for neuroimaging include status epilepticus, signs of increased intracranial pressure, notably different mental state compared with prior exams, or an abnormal neurologic exam. A lower percentage indicates better performance, as reflected by avoiding CT imaging when it is not indicated. This measure was tested using medical record data after administrative claims were used to identify the eligible population. There are currently no known existing quality measures specific to CT imaging of children with seizure.

First seizures are common; every year, it is anticipated that up to 40,000 children in the United States will experience a first seizure. Neuroimaging is used in pediatric patients who have experienced a seizure to evaluate for structural brain abnormalities that may require surgical intervention or predispose to future seizures. However, clinical guidelines maintain that children who present for evaluation after a first generalized, afebrile seizure and meet low-risk criteria can be safely discharged without emergent neuroimaging if follow-up can be assured. While widely available, CT imaging for the evaluation of seizure in children has inferior resolution compared with MRI and is generally low-yield, suggesting overuse of this imaging modality. Further, 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.

Q-METRIC testing results indicate that this measure is feasible using existing data sources. The measure was tested with information abstracted from medical records after administrative claims were used to identify the eligible population. In total, 89 charts were reviewed; 56 (62.9%) met denominator criteria for this measure. Among these, 44 children (78.6%) received CT imaging without a documented indication. This measure provides families with a means to assess the extent to which CT studies are being overused for the evaluation of children with a first generalized afebrile, atraumatic seizure. 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. Certain limitations were observed during measure testing: not all exclusions are captured in administrative claims data and neurologic examinations were not always documented. 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. 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 a first generalized afebrile, atraumatic seizure.

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

b. Percy and Mary Murphy Professor of Pediatrics, School of Medicine; Professor of Health Management and Policy, School of Public Health

c. University of Michigan

d. 300 North Ingalls, Room 6E08, Ann Arbor, MI 48109

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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 2014 and/or 2015 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

Measure 9: Overuse of Computed Tomography Scans for the Evaluation of Children with a First Generalized Afebrile, Atraumatic Seizure

Description

This measure assesses the percentage of children, 1 through 17 years old, for whom computed tomography (CT) imaging of the head is obtained for the evaluation of a first generalized afebrile, atraumatic seizure without indication for CT imaging, including status epilepticus, signs of increased intracranial pressure, notably different mental state compared with prior exams, or an abnormal neurologic exam. A lower percentage indicates better performance, as reflected by avoiding CT imaging when it is not indicated.

Calculation

This measure requires administrative and medical record data and is calculated as follows:

> The percentage of eligible children ages 1 through 17 years old for whom CT imaging of the head is obtained for the evaluation of a first generalized afebrile, atraumatic seizure without indication for CT imaging.

Eligible Population

The determination of the eligible population for this measure requires administrative and medical record data.

Ages	Children at least 1 year old on January 1 of the measurement year but younger than 18 years on December 31 of the measurement year.
Enrollment	Continuous enrollment during both the measurement year and the year prior to the measurement year. Children younger than 2 years old during the measurement year must be continuously enrolled from birth through the end of the measurement year.
Event/Diagnosis	CT imaging study of the head (IMG1) for generalized seizure or convulsions (IMG2) occurring on the day of or up to 30 days prior to imaging, in the absence of a fever (ICD-9 code 780.6x or temperature greater than100.4 degrees Fahrenheit) or trauma (IMG9 and E-codes). (Note, IMG tables begin on page 51.)

Specification

Denominator	The number of eligible children for whom CT imaging of the head is obtained for the evaluation of a first generalized afebrile, atraumatic seizure.

Numerator The number of eligible children for whom CT imaging of the head is obtained for the evaluation of a first generalized afebrile, atraumatic seizure without indication for CT imaging.

Exclusions

- **Denominator Exclusions**

  - Exclusions based on ICD-9-CM codes captured in administrative claims data:
    - Partial seizure (IMG2) on the day of or within the 365 days before imaging was obtained
    - Fever (by ICD-9 codes 780.6x) on the day of or day before imaging was obtained
    - Complex febrile seizure (IMG2) on the day of or within the 365 days before the first generalized afebrile, atraumatic seizure in the measurement year
    - Post-traumatic seizure (ICD-9 code 780.33 in IMG2) on the day of or day before imaging was obtained
    - Suspected abuse and neglect or other head trauma (IMG9 or the presence of an E-code in claims data) on the day of or within 7 days before imaging was obtained
    - ICD-9 codes 783.40 (lack of expected normal physiological development) or 783.42 (delayed milestones) on the day of or within the 365 days before the first generalized afebrile, atraumatic seizure in the measurement year
    - Other pre-existing conditions that would warrant imaging (IMG5-IMG8) on the day of or within 365 days before imaging was obtained
    - Infections that would warrant imaging on the day of or within the 365 days before the atraumatic seizure (IMG4)
    - Lumbar puncture (IMG10) on the day of or day after imaging was obtained
    - Imaging study obtained on the day of or within the 180 days following neurosurgical intervention (IMG10)

  - Exclusions based on clinical documentation:
    - Partial seizures
    - Fever
    - Complex febrile seizures
    - Post-traumatic seizure
    - Trauma such as skull fracture, concussion, intracranial hemorrhage and suspected abuse
    - Developmental delay, lack of expected normal physiological development or delayed milestone
    - Pre-existing conditions that would warrant imaging, such as neoplasm and blood disorder, hydrocephalus and CNS anomalies, hemangioma, phlebitis/ thrombophlebitis, occlusion of cerebral arteries, moyamoya disease, tumor, hemorrhage, or tuberous sclerosis
    - Infection such as meningitis, brain abscess, HIV, and encephalitis

        - Lumbar puncture
        - Imaging as part of surgical evaluation for seizure management (pre-operative or post-operative) on the day of or within the 30 days prior to the generalized afebrile, atraumatic seizure
        - Neurological surgery

- **Numerator Exclusions**

    - Exclusions based on clinical documentation:
        - Status epilepticus
        - Signs or symptoms of increased intracranial pressure
        - Notably different mental state when compared with the child's own prior exams (Key words and phrases that might be mentioned in the medical record during the visit [same date/up to 30 days prior] where imaging was obtained include 'not as attentive,' 'more easily distracted,' 'slower to respond,' 'glassy-eyed,' etc. Note that children should be compared with their own baseline and not to appropriate norms based on age and sex.)
        - An abnormal neurologic exam between the time of diagnosis and the time of imaging (Indications of an abnormal neurologic exam include references to alertness, facial and extremity muscle movements, sensation, etc.)

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
Magnetic Resonance Imaging (MRI) of Brain/Head	Revenue (UB-92)	610, 611, 612, 613, 614, 615, 616, 617, 618, 619
	CPT	70551, 70552, 70553
	ICD-9-CM	88.91

Table 2[=IMG2]: Epilepsy and Recurrent Seizures

General Diagnosis	Diagnosis Details	ICD-9-CM Code
Epilepsy and recurrent seizures		
Generalized non-convulsive	Absences (atonic, typical), minor epilepsy, petit mal, pykno-epilepsy, seizures (akinetic, atonic)	345.0
Generalized convulsive	Epileptic seizures (clonic, tonic, myoclonic, tonic-clonic), grand mal, major epilepsy	345.1
Petit mal status	Epileptic absence status	345.2
Grand mal status	Status epilepticus NOS	345.3
Localized-related (focal) (partial) epilepsy and epileptic syndromes with complex partial seizures	Epilepsy (limbic system partial, psychomotor, psychosensory, temporal lobe), Epileptic automatism	345.4
Localized-related (focal) (partial) epilepsy and epileptic syndromes with simple partial seizures	Epilepsy (Bravais-Jacksonian NOS, focal (motor) NOS, Jacksonian NOS, motor partial, partial NOS, sensory-induced, somatomotor, somatosensory, visceral, visual	345.5
Infantile spasms	Hypsarrhythmia, Lightning spasms, Salaam attacks	345.6
Epilepsia partialis continua	Kojevnikov's epilepsy	345.7
Other forms of epilepsy and recurrent seizures	Cursive [running] gelastic	345.8
Epilepsy, unspecified	Epileptic convulsions, fits or seizures NOS, recurrent seizures NOS, seizure disorder NOS	345.9
General Symptoms		
	Simple febrile seizure	780.31
	Complex febrile seizure	780.32
	Post-traumatic seizure	780.33
	Other convulsions	780.39

Table 3 [=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

Table 4 [=IMG5]: Neoplasm/Blood Disorder

General Diagnosis	Diagnosis Detail	ICD-9-CM Code
Malignant neoplasm of brain		191.x
Malignant neoplasm of pituitary gland		194.3
Malignant neoplasm of pineal gland		194.4
Secondary malignant neoplasm of other sites – brain		198.3
Benign neoplasm of brain		225.0
Benign neoplasm of cranial nerves		225.1
Benign neoplasm of cerebral meninges		225.2
Neoplasm of uncertain behavior – pituitary		237.0
Neoplasm of uncertain behavior – pineal gland		237.1
Neurofibromatosis		237.7x
Personal history of malignant neoplasm of – brain		V10.85
Sickle cell disease		282.6
Pancytopenia		284.1
Coagulation defects		286.x
Purpura and other hemorrhage conditions	Qualitative platelet defects	287.1
	Primary thrombocytopenia	287.3x
	2ndary thrombocytopenia	287.4
	Thrombocytopenia, unspecified	287.5
	Other specified hemorrhagic conditions	287.8
	Unspecified hemorrhage conditions	287.9
Other specific diseases of blood and blood forming organs	Primary hypercoagulable state	289.81
	2ndary hypercoagulable state	289.82
Anticoagulants *(Adverse Effects in Therapeutic Use)*		E934.2
Long-term (current) use of anticoagulants		V58.61
Long-term (current) use of antiplatelets/antithrombotics		V58.63

Table 5[=IMG6]: Hydrocephalus and Central Nervous System Anomalies

General Diagnosis	Diagnosis Detail	ICD-9-CM Code
Precocious puberty		259.1
Hydrocephalus		
Obstructive hydrocephalus		331.4
Congenital hydrocephalus		742.3
Spina bifida with hydrocephalus		741.0
Mechanical complication of CNS device, implant, graft		996.2
Infection and inflammatory reaction due to CNS device, implant, and graft		996.63
Other complications of internal prosthetic device, implant, and graft due to CNS device, implant, and graft		996.75
Presence of cerebrospinal fluid drainage device		V45.1
Mucopolysaccharidosis (hydrocephalus and seizure)		277.5
CNS and skull anomalies		
Other congenital anomalies of nervous system	Encephalocele	742.0
Reduction deformities of brain	Absence part of brain, agenesis part of brain, agyria, lissencephaly, microgyria, etc	742.2
Other specified anomalies of brain	Congenital cerebral cyst, macrocephaly, etc	742.4
Conditions increasing risk for Hydrocephalus		
	Dwarfism, NOS	259.4
	Achondroplastic dwarfism	756.4
	Spina bifida	740.x
Other congenital musculoskeletal anomalies	Anomalies of skull face bones Includes craniosynostosis	756.0
Other and unspecified congenital anomalies	Tuberous sclerosis	759.5
Other conditions of the brain	Cerebral cysts	348.0
	Idiopathic intracranial hypertension	348.2
Encephalopathy, NEC		348.31, 348.39
CNS complications from surgically implanted device		349.1

Table 6 [=IMG7]: Congenital Heart Disease

General Diagnosis	Diagnosis Detail	ICD-9-CM Code
Bulbus cordis/cardiac septal closure anomalies	Common truncus	745.0
	Transposition	745.1x
	Tetrology of Fallot	745.2
	Common Ventricle	745.3
	Ventricular Septal Defect	745.4
	Atrial septal defect	745.5
	Endocardial cushion defects	745.6
	Cor biloculare	745.7
	Other	745.8
	Unspecified	745.9
Other congenital anomalies of the heart	Anomalies of pulmonary valve	746.0
	Tricuspid atresia and stenosis	746.1
	Ebstein's anomaly	746.2
	Stenosis of aortic valve	746.3
	Insufficiency of aortic valve	746.4
	Congenital mitral stenosis	746.5
	Congenital mitral insufficiency	746.6
	Hypoplastic left heart	746.7
Other specified anomalies of the heart	Subaortic stenosis	746.81
	Cor triatriatum	746.82
	Infundibular pulmonic stenosis	746.83
	Obstructive anomalies of heart	746.84
Other personal history presenting hazards to health	Surgery to heart and great vessels	V15.1

Table 7 [=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 8 [=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 9 [=IMG10]: CPT Codes to Identify Lumbar Puncture and Recent Neurosurgical Procedures

Procedure	CPT Code
Spinal Tap	
Spinal puncture lumbar diagnostic	62270
Spinal tap	03.31
Anesthesia for dx or therapeutic lumbar puncture	635
Neurosugery	
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

Procedure	CPT Code
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

Procedure	CPT Code
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 surgery, other than temporal lobe, partial or total	61539
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

Procedure	CPT Code
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 with or without internal fixation, without bone graft	61586
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

Procedure	CPT Code
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),	61635

Procedure	CPT Code
including balloon angioplasty, if performed	
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

Procedure	CPT Code
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, subthalamic nucleus, periventricular, periaqueductal gray), with use of intraoperative microelectrode recording; first array	61867
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

Procedure	CPT Code
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-sphenoidal approach	62165
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 11[=IMG11]: Signs and Symptoms of Increased Intracranial Pressure or Herniation

GENERAL DIAGNOSIS	DIAGNOSIS DETAIL	ICD-9-CM CODE
Pupillary function	Anisocoria	379.41
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
	Facial weakness	781.94
Other	Compression of the brain	348.4
	Cerebral edema	348.5