

Ratio of Magnetic Resonance Imaging Scans to Computed Tomography Scans for the Evaluation of Children with Atraumatic Headache

Section 1. Basic Measure Information

1.A. Measure Name

Ratio of Magnetic Resonance Imaging Scans to Computed Tomography Scans for the Evaluation of Children with Atraumatic Headache

1.B. Measure Number

0196

1.C. Measure Description

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

This measure assesses the ratio of the number of magnetic resonance imaging (MRI) scans to the number of computed tomography (CT) scans obtained on or within the 30 days after the date of evaluation for atraumatic headache for children, ages 4 through 17 years, within the measurement year. A higher ratio of MRI to CT scans indicates better performance, as reflected by a smaller number of children being exposed to radiation as a result of neuroimaging.

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

CT and MRI of the brain are the neuroimaging modalities at the center of this overuse measure. Both are radiologic modalities used to create images of internal structures in a slice-by-slice manner. CT uses X-ray radiation (hereafter simply called radiation), and MRI uses magnetic fields and radio waves. CT scans are simple to order because the technology is readily available (Ginde, Foianini, Renner, et al., 2008), fast, and less expensive to perform than MRI. MRI, however, has advantages for the assessment of children with atraumatic headache because it does not involve radiation and offers better spatial resolution for identifying structural causes of

headaches. This measure is focused on the overuse of CT in the setting of headache, a problem that has gained national attention in recent years (Loder, Weizenbaum, Frishberg, et al., 2013). Overuse has been defined as any patient who undergoes a procedure or test for an inappropriate indication (Lawson, Gibbons, Ko, et al., 2012).

While there are valid reasons for obtaining neuroimaging to characterize atraumatic headaches — specifically when concern exists regarding an underlying condition such as an arteriovenous malformation or tumor — in general, the yield of neuroimaging in the evaluation of patients with headache and a normal neurologic examination is quite low (ACR Expert Panel on Pediatric Imaging, Hayes et al., 2012; Chu, Shinnar, 1992; Evans, 1996; Gandhi, Lewis, Evans, et al., 2015; Lateef, Grewal, McClintock, et al., 2009; Lateef, Kriss, Carpenter, et al., 2012). Yet, neuroimaging is increasingly used to evaluate for structural abnormalities of the brain in pediatric patients who experience headache (Broder, Fordham, Warshauer, 2007; Graf, Kayyali, Alexander, et al., 2008; Larson, Johnson, Schnell, et al., 2011). Such neuroimaging studies rarely result in a change in care management, suggesting overuse in the evaluation of children who have experienced an atraumatic headache (Lateef, Grewal, et al., 2009). In its guidelines for imaging children with secondary headaches accompanied by neurological signs or symptoms of increased intracranial pressure, the American College of Radiology (ACR) recommends MRI; CT is suggested as an alternative in instances where MRI is unavailable or problems with sedation arise (ACR Expert Panel, Hayes et al., 2012).

Imaging overuse subjects children to a number of risks (Malviya, Voepel-Lewis, Eldevik, et al., 2000; Mathews, Forsythe, Brady, et al., 2013; Pearce, Salotti, Little, 2012; Wachtel, Dexter, Dow, 2009). Children who undergo CT scans in early life 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 MRI and longer CT imaging sequences. These complications include compromised airway, hypoxia leading to central nervous system injury, and death. Additionally, overuse of imaging creates cost burdens for the patient, as well as for payers. Providers should carefully consider the risks and benefits of neuroimaging before ordering. The overuse of CT imaging when MRI is a reasonable alternative for the characterization of atraumatic headache is the central focus of this measure.

This measure uses administrative claims data and is calculated as the ratio of MRI scans to CT scans obtained on or within 30 days after the date of evaluation for atraumatic headache for children, ages 4 through 17 years, within the measurement year.

1.D. Measure Owner

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

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

Not applicable.

1.F. Measure Hierarchy

Please note here 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:

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.

2. **Please identify the name of the measure set to which the measure belongs (if applicable). A set is the second level of the hierarchy. A set may include one or more subsets, composites, and/or individual measures.**

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

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.

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.

1.G. Numerator Statement

The numerator is the number of MRI scans of the head obtained on or within 30 days after the date of evaluation for atraumatic headache among children, ages 4 through 17 years, within the measurement year.

Eligible children must be ages 4 through 17 years during the measurement year for which imaging is obtained and must be continuously enrolled in their insurance plan during both the measurement year and the year prior. Imaging may be obtained in any department of the hospital or at sites outside the hospital, such as free-standing imaging facilities and EDs. Each scan obtained on or within the 30 days after the date of evaluation for atraumatic headache is the event used in the calculation. Table 1 [=IMG1; see Supporting Documents] lists Current Procedural Terminology (CPT) codes associated with brain imaging (MRI). International

Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM) codes to identify atraumatic headache are shown in Table 2 [=IMG3; see Supporting Documents]. Atraumatic headache must be diagnosed on the day of or up to 30 days prior to imaging. Atraumatic headaches are those not associated with trauma occurring in the past 7 days.

1.H. Numerator Exclusions

Exclusions based on ICD-9-CM codes captured in administrative claims data:

- Trauma-related headache or pain (Table 2 [=IMG3]; see Supporting Documents) on the day of or within the 7 days prior to imaging.
- Head injury by related ICD-9-CM codes (Table 3 [=IMG9]; see Supporting Documents) or by the presence of an E-code on the day of or within the 7 days prior to imaging.
- Thunderclap headache (Table 2 [=IMG3]; see Supporting Documents) on the day of or within 365 days prior to imaging.
- Vascular disease (Table 4 [=IMG8]; see Supporting Documents) on the day of or within 365 days prior to imaging.

1.I. Denominator Statement

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

Eligible children must be ages 4 through 17 years during the measurement year for which imaging is obtained and must be continuously enrolled in their insurance plan during both the measurement year and the year prior. Imaging may be obtained in any department of the hospital or at sites outside the hospital, such as free-standing imaging facilities and EDs. Each scan obtained on or within the 30 days after the date of evaluation for atraumatic headache is the event used in the calculation. A list of codes for imaging studies of the head (CT) are shown in Table 1 [=IMG1]. Codes to identify atraumatic headache are shown in Table 2 [=IMG3] (see Supporting Documents for tables). Atraumatic headache must be diagnosed on the day of or up to 30 days prior to imaging. Atraumatic headaches are those not associated with trauma occurring in the past 7 days.

1.J. Denominator Exclusions

Exclusions based on ICD-9-CM codes captured in administrative claims data:

- Trauma-related headache or pain (Table 2 [=IMG3]; see Supporting Documents) on the day of or within the 7 days prior to imaging.
- Head injury by related ICD-9-CM codes (Table 3 [=IMG9]; see Supporting Documents) or by the presence of an E-code on the day of or within the 7 days prior to imaging.

- Thunderclap headache (Table 2 [=IMG3]; see Supporting Documents) on the day of or within 365 days prior to imaging.
- Vascular disease (Table 4 [=IMG8]; see Supporting Documents) on the day of or within 365 days prior to imaging. (Note: Some contraindications are guidelines rather than strict rules. As such, a provider may determine that a child should undergo an MRI despite a contraindication).

1.K. Data Sources

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

Administrative data (e.g., claims data), specified and tested; paper medical record, tested; electronic medical record, tested.

If other, please list all other data sources in the field below.

Not applicable.

Section 2: Detailed Measure Specifications

Provide sufficient detail to describe how a measure would be calculated from the recommended data sources, uploading a separate document (+ Upload attachment) or a link to a URL. 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. 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.

Detailed measure specifications are available; please see the Supporting Documents.

Section 3. 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).

3.A. Evidence for General Importance of the Measure

Provide evidence for all applicable aspects of general importance:

- **Addresses a known or suspected quality gap and/or disparity in quality (e.g., addresses a socioeconomic disparity, a racial/ethnic disparity, a disparity for**

Children with Special Health Care Needs (CSHCN), a disparity for limited English proficient (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).**

Atraumatic Headache Prevalence and Incidence

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

Atraumatic Headache Pathology and Severity

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

The precise pathophysiology of headaches is still not fully understood, but research suggests that complex interactions between the neural and vascular systems are involved (Edvinsson, 2001). The manifestation and perception of headache is unique and specific to the child who experiences it. Correspondingly, the management approach for children with headaches often

focuses on reassurance and education by the clinician who evaluates the child (Brna, Dooley, 2006; Raieli, Compagno, Pandolfi, et al., 2010).

Burdens of Using CT Instead of MRI

MRI is generally preferred to CT because of its superior resolution, versatility, and lack of radiation dose (ACR Expert Panel, Hayes, et al., 2012; Gaillard, Cross, Duncan, et al., 2011). An MRI for optimally resolving neurologic structures takes approximately 30 minutes or more to accomplish and will often require sedation to successfully image younger children. CT can be favored in some situations, for example, when imaging must be obtained emergently or there is concern for intracranial hemorrhage.

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, Hoermann, Balassy, et al., 2011).

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, Mahesh, Kim, 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, Perisinakis, Oikonomou, et al., 2011). In children younger than 5 years of age, about 20 percent of the active bone marrow is in the cranium, compared with 8 percent in adults (Christy, 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, 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, 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 and MRI studies. Use of sedation is necessary to avoid motion artifacts, which invariably occur if the child moves during the 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, Bilke, Beach, 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, 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 that results in some degree of respiratory suppression and potential for cardiac depression; the patient cannot be roused by external stimuli or commands (Arthurs, Sury, 2013). Administration of anesthesia raises risks related to the process of intubation for respiratory support, including 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 the 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) (Basu, 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 healthcare system (Callaghan, Kerber, Pace, et al., 2014). As an example, charges for a CT scan of the head 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, Donat, Hernandez-Aquado, 2010; Rogers, Maher, Schunk, et al., 2013).

Performance Gap

Currently, professional guidelines do not support neuroimaging for atraumatic headache in the absence of documented neurologic signs or symptoms that suggest increased intracranial pressure or persistent neurological deficits. While many children with headaches will not benefit from neuroimaging, children experiencing secondary headaches associated with trauma, new neurologic deficits, or signs and symptoms of increased intracranial pressure may require timely imaging. CT is usually the initial imaging modality of choice for patients who require timely

imaging in the acute clinical setting or when intracranial hemorrhage is a concern (ACR Expert Panel, Hayes et al., 2012). CT imaging is readily available in most EDs (Ginde et al., 2008).

The ACR Appropriateness Criteria (ACR Expert Panel, Hayes, et al., 2012) rank MRI as more appropriate than CT in patients with atraumatic headache. MRI will usually be the preferred modality instead of CT because MRI does not use radiation and tends to have improved spatial resolution. Even for the evaluation of time-sensitive conditions such as failure of a ventricular-peritoneal shunt, MRI may be a reasonable alternative to CT for children with atraumatic headaches (Boyle, Paldino, Kimia, et al., 2014; Kim, Torrey, Milla, et al., 2015).

This measure assesses the extent to which MRI is used in relation to CT for neuroimaging of children with atraumatic headache. A higher ratio of MRI scans to CT scans for the neuroimaging of children with atraumatic headache indicates better performance, as reflected by a smaller number of children being exposed to radiation as a result of neuroimaging.

Drivers of Overuse

Atraumatic headache experienced by a child, especially when recurrent, can be a stressful event that may prompt a parent to seek the assistance of a healthcare provider, at times emergently. Some providers may feel pressured by the parent to order imaging despite the lack of benefit (Daymont, McDonald, Wittmeier, et al., 2014; Raieli, et al., 2010). This circumstance has a close parallel to parents who seek out 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, 2013). An ongoing dialogue between providers and parents regarding the risks and benefits of neuroimaging for the evaluation of children who experience an atraumatic headache is a key feature of avoiding overuse.

The practice of defensive medicine is another reason an imaging study may be ordered. Physicians may be uncomfortable facing uncertainty regarding the etiology of headache in children they are evaluating and treating. Assurance behaviors (e.g., ordering of additional tests) are expected when a malpractice-sensitive physician is faced with a potentially worrisome condition (e.g., a brain tumor) that can cause the symptom in question, in this case a headache (Carrier, Reschovsky, Katz, 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, Mello, Sage, et al. 2005). Physicians practicing in the ED 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.

3.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).**
- **Any other specific relevance to Medicaid/CHIP (please specify).**

Virtually any alteration in resource utilization or expenditure substantially affects children covered by Medicaid or CHIP, 30.6 million or 40 percent of children through the age of 18 years were Medicaid recipients in 2008 (Tang, 2011). Although data have not been collected on the number of children with headache who are enrolled in Medicaid or CHIP, efforts curtailing the overuse of imaging will reduce radiation exposure, poor anesthesia or sedation outcomes, and costs.

3.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 imaging with CT when MRI would be a reasonable alternative for the evaluation of children with atraumatic headache.

Section 4. Measure Categories

CHIPRA legislation 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, 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.

Does the measure address this category?

- Care Setting – ambulatory: Yes.**
- Care Setting – inpatient: Yes.**
- Care Setting – other – please specify: No.**
- Service – preventive health, including services to promote healthy birth: No.**
- Service – care for acute conditions: Yes.**
- Service – care for children with special health care needs/chronic conditions: Yes.**
- Service – other (please specify): No.**

- h. **Measure Topic – duration of enrollment:** No.
- i. **Measure Topic – clinical quality:** Yes.
- j. **Measure Topic – patient safety:** Yes.
- k. **Measure Topic – family experience with care:** No.
- l. **Measure Topic – care in the most integrated setting:** No.
- m. **Measure Topic other (please specify):** No.
- n. **Population – pregnant women:** No.
- o. **Population – neonates (28 days after birth) (specify age range):** No.
- p. **Population – infants (29 days to 1 year) (specify age range):** No.
- q. **Population – pre-school age children (1 year through 5 years) (specify age range):** Yes; ages 4 through 5 years.
- r. **Population – school-aged children (6 years through 10 years) (specify age range):** Yes; all ages in this range.
- s. **Population – adolescents (11 years through 20 years) (specify age range):** Yes; ages 11 through 17 years.
- t. **Population – other (specify age range):** No.
- u. **Other category (please specify):** Not applicable.

Section 5. 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.

5.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 overuse of CT scans among children, ages 4 through 17 years, being evaluated for atraumatic headache, by calculating a ratio comparing the number of MRI and CT scans obtained in this population.

Well-established evidence shows that neuroimaging to characterize headache, in the absence of documented neurologic signs or symptoms that suggest intracranial pathology, is rarely clinically indicated and is potentially harmful (ACR Expert Panel, Hayes, et al., 2012; Lateef, Grewal, et al., 2009). When imaging is deemed necessary, providers must weigh the risks of radiation exposure and possibly sedation or anesthesia with the benefits of the available imaging modalities. Table 6 (see Supporting Documents) summarizes key sources of evidence for this measure, using the U.S. Preventive Services Task Force (USPSTF) rankings (criteria denoted in a note to the table). The ACR, in addition to evidence-based guidelines noted below, has also published specific "Appropriateness Criteria" for pediatric headache (Figures 1 and 2; see Supporting Documents).

5.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.

Not applicable.

Section 6. 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.

6.A. Reliability

Reliability of the measure is the extent to which the measure results are reproducible when conditions remain the same. The method for establishing the reliability of a measure will depend on the type of measure, data source, and other factors.

Explain your rationale for selecting the methods you have chosen, show how you used the methods chosen, and provide information on the results (e.g., the Kappa statistic). Provide appropriate citations to justify methods.

To evaluate the reliability of using administrative claims for the calculation of this measure, we conducted a signal-to-noise analysis. This analysis was focused on assessing the ability to confidently distinguish the performance of one State health plan from that of another State. To perform the signal-to-noise analysis, we used the Medicaid Analytic eXtract (MAX) administrative claims data provided by the Centers for Medicare & Medicaid Services (CMS) from 2006 to 2010 for seven State Medicaid programs: Colorado, Florida, Illinois, Massachusetts, Michigan, Texas, and Utah. Table 7 (see Supporting Documents) presents a summary of the number of MRI and CT scans per State and year. Ratios varied between States, ranging from a low of 0.25 in Illinois (2007) to a high of 0.67 in Utah (2009, 2010). Lowest to highest ratios of MR to CT imaging within each State across the 5-year period were as follows:

Colorado (0.33 vs. 0.47), Florida (0.44 vs. 0.54), Illinois (0.25 vs. 0.31), Massachusetts (0.50 vs. 0.60), Michigan (0.30 vs. 0.49), Texas (0.37 vs. 0.40), and Utah (0.34 vs. 0.67).

For this approach, reliability was estimated with a beta-binomial model (Adams, 2009). This approach is applicable in instances where the numerator is a subset of the denominator; for reliability testing, the numerator was defined as the number of MRIs, and the denominator was defined as (number of CTs + number of MRIs). We tested the reliability using aggregate data from the seven States, 2006-2010.

Reliability Results

Reliability results are detailed in Table 8 (see Supporting Documents). These results show that the reliability based on signal-to-noise analysis ranged from 0.90 to 1.00, with a median of 0.99.

Reliability Conclusions

The reliability is very good; observed reliability was consistently greater than 0.90. In general, reliability scores can range from 0.0 (all variation is attributable to measurement error) to 1.0 (all variation is caused by real differences). While there is not a clear cut-off for a minimum reliability level, values above 0.7 are considered sufficient to distinguish differences between some health plans and the mean; reliability values above 0.9 are considered sufficient to see differences between health plans (Adams, 2009). The median reliability observed across State Medicaid programs tested for this measure was 0.99 (range: 0.90-1.00), which is consistent with a high degree of reliability.

6.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., R2 for concurrent validity).

Face Validity

Face validity is the degree to which the measure construct characterizes the concept being assessed. The face validity of this measure concept was established by a national panel of experts and parent representatives for families of children with headaches and seizures convened by Q-METRIC. The Q-METRIC panel included nationally recognized experts in the area of imaging children, representing general pediatrics, pediatric radiology, pediatric neurology, pediatric neurosurgery, pediatric emergency medicine, general emergency medicine, and family medicine. In addition, face validity of this measure concept was considered by experts in State Medicaid program operations, health plan quality measurement, health informatics, and healthcare 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 concept has a high degree of face validity through a detailed review of concepts and metrics considered to be essential to appropriately imaging children. Concepts and draft measures were rated by this group for their relative importance. This measure received an average score of 6.7 (with 9 as the highest possible score).

Validity of the Performance Measure Score

We assessed the validity of the measure performance score using administrative claims compared with the gold standard of the medical record.

Identification of the Study Population

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 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, 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 4 through 17 years who had an atraumatic headache (27,005; 73.0 percent). From this group, 1,612 children (6.0 percent) had received an MRI, and 3,033 children (11.2 percent) had received a CT scan on or within 30 days after date of diagnosis for an atraumatic headache.

Providers associated with the eligible children's visits were identified; the final sampling population consisted of children who were linked to a provider with available contact information, resulting in 1,232 children (76.4 percent) who had received an MRI and 2,289 children (75.5 percent) who had received a CT scan. Once subjects were identified, patient medical records were requested from provider offices and healthcare facilities; records were sent to a centralized location for data abstraction. To ensure an adequate number of cases to test the validity of this measure, we set a target sample of approximately 200 completed charts for abstraction. In total, 190 charts (66 charts for children receiving an MRI and 124 charts for children receiving a CT scan) were abstracted.

Trained medical record abstractors collected and entered information from paper copies of the medical records 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.

To facilitate comparisons between administrative claims and information abstracted from the medical chart, this validation study used the ratio of the total number of children with at least one MRI scan within the measurement year to the total number of children with at least one CT scan within the measurement year.

Ratio of MRI to CT Using Administrative Claims Data

After applying claims-based exclusions to cases in the HIRD, 1,387 children were identified as being eligible for the numerator (MRI obtained), and 1,815 children were identified as being eligible for the denominator (CT obtained). The ratio of MRI to CT scans of eligible children using the first imaging event on or within 30 days after the date of diagnosis of an atraumatic headache was $(1,387/1,815) = 0.76$.

Ratio of MRI to CT Using Abstracted Medical Record Data

Within the sample of medical records received for chart review ($n=190$, see identification of study population above), 66 children (34.7 percent) had received an MRI, and 124 children (65.3 percent) had received a CT scan. Of the 66 children who received an MRI and underwent chart review, 48 (72.7 percent) met criteria for inclusion in the numerator population. Of the 124 children who received a CT scan and underwent chart review, 68 (54.8 percent) met criteria for inclusion in the denominator population. Among children who were included in chart review, the ratio of MRI to CT scans obtained for the evaluation of children within 30 days of diagnosis of an atraumatic headache was $48/68 = 0.71$, similar to the ratio calculated from administrative claims data.

Accuracy of Administrative Claims

The sensitivity, specificity, negative predictive value (NPV), and positive predictive value (PPV) of administrative claims to identify the presence of exclusions were calculated; the medical charts were the gold standard for comparison. In addition, the reliability of the data elements abstracted from the medical chart was assessed by identifying a subset of the charts to be re-abstracted by another trained medical record abstractor; the results of the two abstractors were compared using percent agreement and kappa.

Numerator (MRI): Among children with at least one MRI ($n=66$), two children had exclusion criteria present in both claims and charts, and 46 children had no exclusion criteria present in either claims or charts. Two children had evidence of exclusion criteria in claims, but not in charts; 16 children had evidence of exclusion criteria in charts, but not in claims (Table 9; see Supporting Documents). Therefore, the sensitivity of claims for identification of exclusion criteria was 41 percent (95 percent CI: 28 to 55), the specificity was 94 percent (95 percent CI:

86 to 98), the PPV was 85 percent (95 percent CI: 66 to 96), and the NPV was 66 percent (95 percent CI: 56 to 75).

Denominator (CT): Among children with at least one CT (n=124), 23 children had exclusion criteria present in both claims and charts, and 64 children had no exclusion criteria present in either claims or charts. Four children had evidence of exclusion criteria in claims, but not in charts; 33 children had evidence of exclusion criteria in charts, but not in claims (Table 10; see Supporting Documents). Therefore, the sensitivity of claims for identification of exclusion criteria was 11 percent (95 percent CI: 1 to 35), the specificity was 96 percent (95 percent CI: 86 to 99), the PPV was 50 percent (95 percent CI: 7 to 93), and the NPV was 75 percent (95 percent CI: 62 to 84).

Reliability of Abstracted Medical Record Data

Reliability of medical record data was determined through re-abstraction of patient record data to calculate the inter-rater reliability (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, we compared the medical record data collected by three abstractors with the data obtained by a senior abstractor. Any differences were remedied by review of the chart. IRR was determined by calculating both percent agreement and Cohen's kappa statistic. In total, data were abstracted from the medical records of 190 eligible children: 66 who had received an MRI and 124 who had received a CT scan. Of these, eight records (12.1 percent) from the MRI group and 18 records (14.5 percent) from the CT group were reviewed for IRR. IRR was assessed by comparing abstractor agreement with a senior abstractor on 10 questions included in the chart abstraction form for this measure. Overall, abstractor agreement was 100 percent; the kappa statistic was 1.0, indicating that a perfect level of agreement was achieved.

Conclusion

The ratio of MRI to CT derived from the gold standard of medical records (0.71) compared with the ratio of MRI to CT obtained solely from administrative claims (0.76) suggests that administrative claims have a high degree of validity. In addition, administrative claims are highly specific in respect to the exclusion criteria compared with the gold standard of medical records. Therefore, we conclude that administrative claims alone can be used to calculate this measure.

Section 7. 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.

7.A. Race/Ethnicity

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 (U.S. 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 11 and 12 (see Supporting Documents).

Overall, sampled children reside in ZIP codes reporting primarily white race (range: 76.9 to 81.5 percent) and within ZIP codes reporting modest levels of Hispanic ethnicity (7.9 to 14.0 percent).

7.B. Special Health Care Needs

The medical records data abstracted for this measure did not include indicators of special healthcare needs.

7.C. Socioeconomic Status

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) (U.S. 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 13 (see Supporting Documents).

Overall, the ZIP code-level median household income ranged from \$65,601 to \$73,828 for our groups of sampled children.

7.D. Rurality/Urbanicity

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, (U.S. Census Bureau, 2010). The summary statistics for urbanicity within ZIP code for sampled groups of children with valid ZIP codes are reported in Table 14 (see Supporting Documents).

Overall, the ZIP codes of all groups of sampled children were largely categorized as being urban (71.3 to 80.0 percent).

7.E. Limited English Proficiency (LEP) Populations

The medical records data abstracted for this measure did not include indicators of LEP.

Section 8. 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. Using the following sections, explain the methods used to determine the feasibility of implementing the measure.

8.A. Data Availability

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

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

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?

The use of ICD-10-CM codes is now required. For ease of future implementation, the ICD-9-CM codes used in this measure will need to be converted to ICD-10-CM.

8.B. Lessons from Use of the Measure

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, the measure is not currently in use anywhere in the United States.

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.

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

Not applicable.

Section 9. 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 the 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.

Level of aggregation (Unit) for reporting on the quality of care for children covered by Medicaid/ CHIP†:

State level* Can compare States

Intended use: Is measure intended to support meaningful comparisons at this level? (Yes/No)

No.

Data Sources: Are data sources available to support reporting at this level?

Not applicable.

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?

Not applicable.

In Use: Have measure results been reported at this level previously?

Not applicable.

Reliability & Validity: Is there published evidence about the reliability and validity of the measure when reported at this level of aggregation?

Not applicable.

Unintended consequences: What are the potential unintended consequences of reporting at this level of aggregation?

Not applicable.

Other geographic level: Can compare other geographic regions (e.g., MSA, HRR)

Intended use: Is measure intended to support meaningful comparisons at this level? (Yes/No)

No.

Data Sources: Are data sources available to support reporting at this level?

Not applicable.

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?

Not applicable.

In Use: Have measure results been reported at this level previously?

Not applicable.

Reliability & Validity: Is there published evidence about the reliability and validity of the measure when reported at this level of aggregation?

Not applicable.

Unintended consequences: What are the potential unintended consequences of reporting at this level of aggregation?

Not applicable.

Medicaid or CHIP Payment model: Can compare payment models (e.g., managed care, primary care case management, FFS, and other models)

Intended use: Is measure intended to support meaningful comparisons at this level? (Yes/No)

No.

Data Sources: Are data sources available to support reporting at this level?

Not applicable.

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?

Not applicable.

In Use: Have measure results been reported at this level previously?

Not applicable.

Reliability & Validity: Is there published evidence about the reliability and validity of the measure when reported at this level of aggregation?

Not applicable.

Unintended consequences: What are the potential unintended consequences of reporting at this level of aggregation?

Not applicable.

Health plan*: Can compare quality of care among health plans.

Intended use: Is measure intended to support meaningful comparisons at this level? (Yes/No)

Yes.

Data Sources: Are data sources available to support reporting at this level?

This measure requires administrative claims.

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?

The number of children meeting inclusion criteria will vary by plan. Given the reliability results in Section 6, we expect the reliability of this measure to diminish to below 0.80 if fewer than 800 total imaging studies are performed. Our results indicate that among children ages 4 through 17 years with an atraumatic headache (n=27,005), there were a total of 4,645 CTs and MRIs (0.17 per child). Approximately a third of those scans were excluded from the numerator and/or denominator, leaving a total of 3,202 imaging studies available for this calculation (0.12 scans per child). Therefore, to reach the target of 800 total imaging studies, approximately 6,600 children ($800/0.12$) with atraumatic headache within the measurement year would be necessary.

In Use: Have measure results been reported at this level previously?

Not applicable.

Reliability & Validity: Is there published evidence about the reliability and validity of the measure when reported at this level of aggregation?

Not applicable.

Unintended consequences: What are the potential unintended consequences of reporting at this level of aggregation?

Not applicable.

Provider Level

Individual practitioner: Can compare individual health care professionals

Intended use: Is measure intended to support meaningful comparisons at this level?

(Yes/No)

No.

Data Sources: Are data sources available to support reporting at this level?

Not applicable.

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?

Not applicable.

In Use: Have measure results been reported at this level previously?

Not applicable.

Reliability & Validity: Is there published evidence about the reliability and validity of the measure when reported at this level of aggregation?

Not applicable.

Unintended consequences: What are the potential unintended consequences of reporting at this level of aggregation?

Not applicable.

Provider Level

Hospital: Can compare hospitals

Intended use: Is measure intended to support meaningful comparisons at this level?

(Yes/No)

Yes.

Data Sources: Are data sources available to support reporting at this level?

This measure requires administrative claims data.

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?

This measure has not been tested at the hospital level; consequently, the minimum number of patients required per hospital has not been determined.

In Use: Have measure results been reported at this level previously?

Not applicable.

Reliability & Validity: Is there published evidence about the reliability and validity of the measure when reported at this level of aggregation?

Not applicable.

Unintended consequences: What are the potential unintended consequences of reporting at this level of aggregation?

Not applicable.

Provider Level

Practice, group, or facility: Can compare: (i) practice sites; (ii) medical or other professional groups; or (iii) integrated or other delivery networks**

Intended use: Is measure intended to support meaningful comparisons at this level?

(Yes/No)

No.

Data Sources: Are data sources available to support reporting at this level?

Not applicable.

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?

Not applicable.

In Use: Have measure results been reported at this level previously?

Not applicable.

Reliability & Validity: Is there published evidence about the reliability and validity of the measure when reported at this level of aggregation?

Not applicable.

Unintended consequences: What are the potential unintended consequences of reporting at this level of aggregation?

Not applicable.

Section 10. 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 a means to assess the extent to which CT studies are being overused when MRI would be a reasonable alternative for the evaluation of children with headache in whom neuroimaging is warranted. Higher use of MRI will yield a higher ratio that is easily understood to be preferable. The simplicity of the measure likewise makes it a straightforward guide for providers and purchasers to assess overuse of CT when MRI would be a reasonable alternative for the evaluation of children with headache in whom neuroimaging is warranted. The primary information needed for this measure is sourced from administrative claims data and includes basic demographics, diagnostic codes, and procedure codes, all of which are widely available.

Section 11. 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 measure calculation.

11.A. Health IT Enhancement

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

Health information technology (IT), such as computerized provider order entry (CPOE), may improve the use of this measure. CPOE will provide an actual order for imaging, the date ordered, and prescriber's signature. However, those data will not furnish information regarding whether the child ever received imaging; the subsequent results reported to the electronic health

record (EHR) will furnish an indicator of completed scans. Technologies that support the capture and query of structured data fields from EHRs, such as CPOE, and imaging study results, will facilitate future enhancements to this measure.

Although individual providers will increasingly have access to information within their respective EHR systems for children, the completeness of imaging studies within their respective EHRs may be limited by interoperability with other providers' EHRs that may likewise capture imaging events for these patients. This interoperability will be influenced by health information exchange (HIE) technologies that are rapidly becoming operational throughout the United States.

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

11.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.

11.C. Health IT Workflow

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

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

11.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 (ONC) criteria (see healthit.hhs.gov/portal/server.pt/community/healthit_hhs_gov__standards_ifr/1195)?

Yes.

If yes, please describe.

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 (ONC, 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 CPOE and the electronic transmission of diagnostic test results. Electronic transmission of diagnostic test results includes a broad array of data important to quality measurement, and, for this measure, specifically includes radiology studies such as CT and MR imaging.

11.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:

- Child's date of birth.
- ICD-9-CM or ICD-10-CM codes.
- Date and time of treatment.
- Type of tests administered.
- Date of tests performed.
- Care setting.
- Possibly a scanned or electronic clinical document in the medical record.

11.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 characteristics on the measure?

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 CT/MRI is not indicated. Information buttons could link to educational resources at the point of care to discourage unnecessary ordering and could be used to link previous study results with the act of ordering, which has been shown to decrease the rate of ordering.

Section 12. 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 ratio of the number of MRI scans to the number of CT scans obtained on or within the 30 days after the date of evaluation for atraumatic headache among children ages 4 through 17 years within the measurement year. A higher ratio of MRI to CT scans indicates better performance, as reflected by a smaller number of children being exposed to radiation as a result of imaging.

This measure can be implemented with administrative claims data. Although we saw a slight difference in rates using administrative claims alone compared with the gold standard of medical records, the efficiency of using administrative claims to calculate these ratios may outweigh the benefit of medical record review to capture additional exclusions. In addition, our testing indicates that a large eligible population of children may be required to adequately implement this measure, thereby limiting its applicability among smaller populations.

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.

Section 13. 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 ratio of the number of MRI scans to the number of CT scans obtained on or within the 30 days after date of evaluation for atraumatic headache for children ages 4 through 17 years within the measurement year. A higher ratio of MRI to CT scans indicates better performance, as reflected by a smaller number of children being exposed to radiation as a result of neuroimaging. This measure uses administrative claims data and is calculated as the ratio of MRI to CT scans obtained among eligible children who are evaluated for atraumatic headache. Currently, there are no known existing quality measures specific to minimizing radiation exposure for children undergoing imaging.

Headaches are a common problem in the pediatric population, and children with headaches are frequently evaluated in ED and primary care settings. As a diagnostic tool, CT scans are simple to order because the technology is readily available, fast, and less expensive than an MRI. MRI, however, is usually the preferred choice to assess atraumatic headache, especially in children, because it does not involve radiation and offers better spatial resolution for identifying structural causes of headaches. In contrast, CT imaging for children with atraumatic headache and a normal neurological examination yields little information and exposes children to unnecessary risk from radiation. Children who have CT scans in early childhood tend to be at greater risk for developing leukemia, primary brain tumors, and other malignancies later in life. Young children are also at risk for complications from sedation or anesthesia, which often is required for longer CT imaging sequences. In addition, the cost burden associated with imaging is high.

Q-METRIC testing results indicate that this measure is feasible using existing data sources. This measure is specified using administrative claims. The ratio of MRI to CT derived from the gold standard of medical records (0.71) compared with the ratio of MRI to CT obtained solely from administrative claims (0.76) suggests that administrative claims have a high degree of validity. In addition, administrative claims are highly specific in respect to the exclusion criteria compared with the gold standard of medical records.

This measure provides a means to assess the extent to which CT studies are being overused when MRI would be a reasonable and potentially preferable alternative for the evaluation of children with headache in whom neuroimaging is warranted. 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.

Continuing advances in the development and implementation of EHRs may enable the use of clinical decision support to understand when CT/MRI is not indicated.

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Section 14: Identifying Information for the Measure Submitter

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The CHIPRA Pediatric Quality Measures Program (PQMP) Candidate Measure Submission Form (CPCF) was approved by the Office of Management and Budget (OMB) in accordance with the Paperwork Reduction Act.

The OMB Control Number is 0935-0205 and the Expiration Date is December 31, 2015.

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.

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