



Excessive Radiation Dose or Inadequate Image Quality for Diagnostic Computed Tomography in Adults for use in CMS Hospital Program

Measure Overview

Administered computed tomography (CT) radiation doses are highly variable across patients, radiologists, and hospitals throughout the United States. Some patients receive excessive radiation doses without diagnostic benefit, needlessly increasing their personal risk of developing cancer. This inconsistency in how CT exams are performed represents a modifiable health risk, as doses can be reduced through auditing and feedback to hospitals and physicians.

The Excessive Radiation Dose or Inadequate Image Quality for Diagnostic Computed Tomography (CT) in Adults electronic clinical quality measure (eCQM) is designed to identify when a CT exam is performed with unnecessarily high radiation doses and includes a balancing component to ensure that lowering these radiation doses does not result in increases in image noise to the point that the test loses diagnostic value. Recognizing that appropriate radiation doses vary widely based on patient size, body part, and indication for imaging, each scan is assigned to one of 18 CT categories. Each CT category has separate thresholds for size-adjusted dose and image noise. In validation testing, most CT exams rated as out of range were due to radiation dose rather than image noise.

Measure calculation is performed using DICOM CT pixel data (size normalization and image noise) and DICOM Radiation Dose Structured Report (RDSR) (radiation dose), with imaging indication and exam performed in the form of CPT and ICD-10 codes respectively (CT Category) through the use of software that translates radiology data into an eCQM compatible format. CT scans can be sent to the electronic health record (EHR) directly from CT machines, with a routing rule in PACS, or with a DICOM router.

For each CT scan, the CT images, RDSR, and indication data from the clinical encounter must be ingested and used to calculate three intermediate variables: CT Dose and Image Quality Category, Calculated CT Size-Adjusted Dose, and Calculated CT Global Noise. These new variable results are eCQM compatible and can be used by any vendor capable of calculating eCQM results and reporting to CMS.

Common Questions

Does the measure consider why a CT scan was performed? Yes, a CT done for a suspected kidney stone is not assessed against the same radiation dose and image noise thresholds as a CT done for abdominal pain or a suspected aortic dissection. The relationship between different indications for CT and the CT categories has been published in peer-reviewed medical literature.



Does the measure consider patient size? Yes, patient size is an important contributor to dose and is accounted for through normalization of the total dose based on patient diameter measured from the images. The purpose of the size adjustment is to ensure that heterogeneity of patient size between sites does not unfairly impact measure score. In extensive testing, the size adjustment successfully accounted for the impact of differently sized patients in assessing whether the radiation dose and image noise were within range.

Why doesn't the measure include other variables in the calculation such as patient demographics or the type of scanner used to perform the test? In extensive research, the only patient factor that is a strong predictor of dose is patient size. Other patient factors (e.g., adult age, sex) have little association with radiation dose. Further, the addition of more variables would increase complexity of measure calculation, increasing burden without benefit.

How were image noise thresholds established, and will radiologists be inundated with low image quality CTs? The measure sets a standard for acceptable image noise and radiation dose within each CT category. These thresholds were established using a rigorous research design in which a broad range of radiologists' assessments were used as a gold standard. During testing, fewer than 1% of studies were assessed to have unacceptable image noise (range of 0.0% - 0.6% across hospitals).

How can I as a Provider be responsible for radiation dose levels given the hospital pays for and manages the machinery and technologists? The measure has been adopted for the Hospital Inpatient Quality Reporting Program, the Hospital Outpatient Quality Reporting Program, and the Merit-based Incentive Payment System (MIPS) expressly to help align physicians, technologists, and hospitals to work together to reduce radiation doses.

How is image quality calculated? The measure was not intended and does not attempt to quantify all aspects of image quality. The measure assesses image noise and is only intended to ensure that radiation dose is not lowered to such a degree that the diagnostic value of the test is compromised.

Implementation Summary

Data Requirements for Measure Computation

Translation software collects the data necessary to calculate three intermediate variables for the measure. The intermediate variables are:

1. **Computerized Tomography (CT) Dose and Image Quality Category:** Reflects the type of exam performed based on body region and clinical indication. Each CT Dose and Image Quality Category has a specific set of dose and image noise thresholds. Translation software sorts studies into a single category (with associated size-adjusted dose, and image noise thresholds) based on the ICD-10 and CPT codes captured at the health care encounter at the time of CT ordering and stored in the EHR, combined with the billed CT examination.
2. **Calculated CT Size-Adjusted Dose:** Reflects the total radiation dose received during a CT after adjusting for patient size. The calculation for this variable normalizes the Dose Length Product (DLP) parsed from the DICOM RDSR and a patient size obtained by

analyzing the images.

3. **Calculated CT Global Noise:** A balancing factor to ensure that dose is not so low that it affects clinical interpretability. The calculated CT Global Noise thresholds vary by the CT Dose and Image Quality Category and are not intended to be a holistic assessment of image quality.

Why Translation Software is Necessary

Electronic clinical quality measure (eCQM) frameworks are based on EHR data. The frameworks cannot currently access and consume elements from ubiquitous DICOM objects, the accepted standard for radiology data. Translation software is needed as a preliminary step to transform primary data from CT scans into a format that can be integrated into EHR systems performing eCQM calculations.

Translation Software

Free translation software is available to hospitals and physician groups by the measure steward, Alara Imaging Inc. More information is available on their [Alara CMS Measure Compliance](#) webpage. The Alara Medical Imaging Gateway has predefined clinical data endpoints for immediate connectivity (Figure 1). Health sites can connect and configure HL7 and DICOM for any available flow directly from the Gateway Management User Interface.

DICOM

The gateway supports both DICOM DIMSE and DICOMWeb protocols. The recommended configuration is for the local site to create a routing rule in their archive or DICOM router to send CT studies to the Alara Medical Imaging Gateway. An alternative configuration is to have the gateway perform query / retrieve from the archive based on the accession numbers received from RIS or EHR data.

HL-7

The gateway supports industry standard HL7v2.x and HL7 FHIR messages to receive CPT and ICD codes.

Tabular Data Exports

While HL7 integration is preferred, alternative options including CSV files on shared network locations will also be supported. We recommend tabular exports as the last option considered, as it requires manual intervention and does not advance the objective of burden reduction.

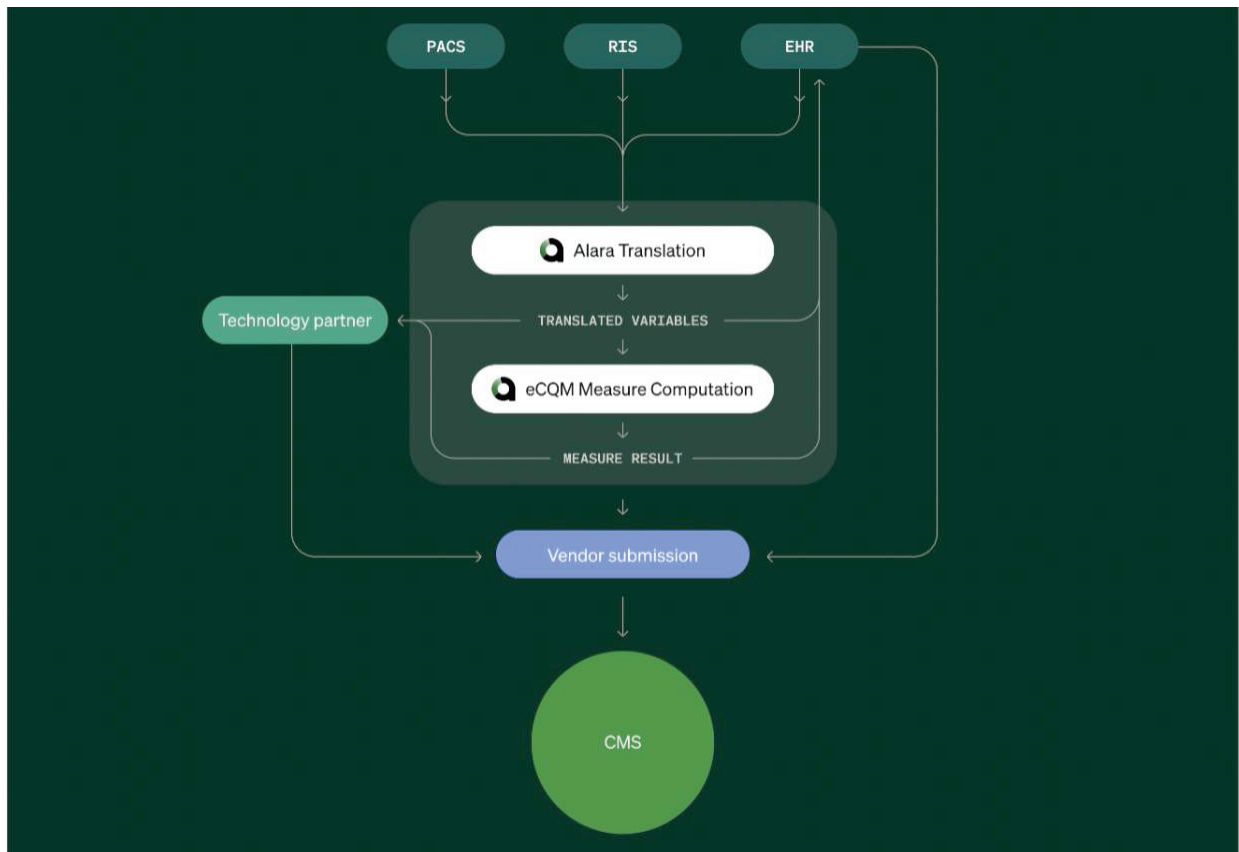


Figure 1

A schematic of how the Alara translation software connects to the primary data elements, calculates the translation variables, and calculate the eCQM results

Free translation software necessary to use this eCQM is written and maintained by Alara Imaging, Inc. However, any software vendor capable of calculating and reporting this eCQM in accordance with the measure's specifications, including combining radiology data with electronic health system data, and transforming radiology data into a format compatible with eCQM reporting, may report this measure on behalf of hospitals and clinicians. Hospitals and clinicians who choose to report this eCQM may use any vendor's software that meets the necessary requirements to generate the standardized data elements required to calculate the measure, consistent with the measure's specifications

For Additional Information

Please visit the [CMS eCQI](#) resource page for measure information from CMS.