American College of Radiology (ACR)

Diagnostic Imaging 2018 - Quality Measures

Developed by ACR's Quality Measures Technical Expert Panel

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Purpose of Measurement Set

The American College of Radiology (ACR) convened a cross-specialty, multi-disciplinary technical expert panel (TEP) to identify and define new measures for quality improvement and potentially for use in Centers for Medicare and Medicaid Services (CMS) quality reporting programs and ACR's National Radiology Data Registry (NRDR), a qualified clinical data registry (QCDR).

The TEP was tasked with developing measures that reflect the most rigorous clinical evidence and address areas most in need of performance improvement. The TEP also evaluated existing ACR measures to identify measurement gap areas, both in terms of type of measure and domain of care, and ensure that proposed measure concepts address identified gap areas. The TEP considered opportunities for outcome and process measures with a focus on diagnostic accuracy, appropriate use of imaging studies, and care coordination.

The first several measures focus on the radiologist's role in clearly defining and communicating radiological exam findings and providing evidence-based recommendations for follow-up, in an effort to reduce patient anxiety and unnecessary follow-up or downstream testing and treatment. The final two measures represent an effort to standardize information that is included in the final report to promote optimal patient management.

The measures in this set represent a new phase in ACR's efforts to develop relevant and meaningful measures for radiologists that promote population health through diagnostic accuracy, clinical effectiveness, care coordination and ultimately improve patient care and outcomes. Future phases of the work will seek to include additional measures that will further these goals.

Measure 1: Use of Structured Reporting in Prostate MRI

Measure Description	Percentage of final reports for male patients aged 18 years and older undergoing prostate MRI that include reference to a validated scoring system such as PI-RADS
Numerator Statement	Final reports that include reference to a validated scoring system such as PI-RADS Examples of validated scoring systems have been included but do not represent an exhaustive list of such systems. A validated local or institutional equivalent may also apply. Additionally, for purposes of meeting the measure, the use of the scoring system is not required for every lesion. Reference to the scoring system for any lesion will apply.
Denominator Statement	All final reports for male patients aged 18 years and older undergoing prostate MRI
Denominator Exclusions	Patients with a diagnosis of prostate cancer
Denominator Exceptions	None
Supporting Guidelines and Other References	The following evidence statements are quoted verbatim from the referenced clinical guidelines and other sources, where applicable: Effective communication is a critical component of diagnostic imaging. Quality patient care can only be achieved when study results are conveyed in a timely fashion to those responsible for treatment decisions. An effective method of communication should: a) promote optimal patient care and support the ordering physician/health care provider in this endeavor; b) be tailored to satisfy the need for timeliness; and c) minimize the risk of communication errors. (ACR, 2014)[1] The report should use appropriate anatomic, pathologic, and radiologic terminology to describe the findings. (ACR, 2014)[1] Current guidelines strongly encourage radiologists to use the PI-RADS™ v2 to report prostate mpMRI findings. It is clear that prostate mpMRI is more commonly used for guiding biopsies rather than local staging. Accurate lesion mapping and dimension measurement are key steps in communicating the results to the referring physicians. (AUA, 2017)[2] Following an initial negative biopsy, there is an ongoing need for strategies to improve patient selection for repeat biopsy as well as the diagnostic yield from repeat biopsies. Many options exist for men with a previously negative biopsy. If a biopsy is recommended, prostate MRI and subsequent MRI-targeted cores appear to facilitate the detection of CS disease over standardized repeat biopsy. Thus, when high-quality prostate MRI is available, it should be strongly considered in any patient with a prior negative biopsy who has persistent clinical suspicion for prostate cancer and who is undergoing a repeat biopsy. The decision whether to perform MRI in this setting must also take into account results of any other biomarkers, the cost of the examination, as well as availability of high quality prostate MRI interpretation. If MRI is done, it should be performed, interpreted, and reported in accordance with PI-RADS V2 guidelines. (SAR/AUA, 2016)[3]
Rationale	Advances in prostate MRI technology along with growing interpreter experience have greatly expanded the clinical applications of this imaging modality to include the detection of prostate

	cancer. As prostate MRI use continues to grow, there is a need for standard and consistent reporting to improve detection, characterization, localization, and risk stratification of prostate lesions.[1] Use of prostate MRI structured reporting has been demonstrated to improve the clinical impact of the radiologist contribution to patient care.[4] Adapting this method of reporting is also associated with a lower perceived need by the urologist to contact the interpreting radiologist for diagnostic clarification, thereby improving the quality and efficiency of provider communication.[4] It is unclear how widespread use of structured reporting systems are used in prostate MRI. However, one study found that even after training and emphasis on its potential to improve report quality, only 36% of imaging studies included in the sample were compliant with the recommended reporting.[4] This measure aims to improve the quality of communication and diagnostic clarity of prostate MRI reports by encouraging adoption of evidence-based structured reporting by radiologists.
Measure Designation	
Measure Purpose	Quality Improvement Accountability
Measure Type	Process
Level of Measurement	Individual Practitioner Group Practice
Care Setting	Ambulatory Inpatient
Improvement Notation	Higher score indicates better quality
National Quality Strategy Priority/CMS Measure Domain	☒ Communication and Care Coordination ☐ Community/Population Health ☒ Effective Clinical Care ☐ Efficiency and Cost Reduction ☐ Patient Safety ☐ Person and Caregiver-Centered Experience

Measure 2: Follow-up Recommendations for Incidental Findings of Renal Masses

Measure Description	Percentage of final reports with an incidental finding of a simple-appearing cystic renal mass on abdominal CT or MR imaging studies for patients aged 18 years or older with a specific recommendation for no follow-up imaging based on radiological findings
Numerator Statement	Final reports describing an incidentally detected simple cystic renal mass with a specific recommendation for no follow-up imaging based on radiological findings
Denominator Statement	All final reports with an incidental finding of a simple-appearing (ie, Bosniak I or II or equivalent*) cystic renal mass on abdominal CT or MR imaging studies for patients aged 18 years and older *Other "simple-appearing criteria": -Incidental renal mass on non-contrast enhanced abdominal CT that does not contain fat, is homogenous in appearance, -10-20 HU or ≥70 HU. (ACR, 2017)[5] -Incidental renal mass on contrast-enhanced abdominal CT that does not contain fat, is homogenous in appearance, -10-20 HU. (ACR, 2017)[5]
Denominator Exclusions	Patients with an active diagnosis or history of cancer (except basal and squamous cell skin carcinoma); Patients who also present with lymphadenopathy or other signs of metastasis; Patients with cystic renal lesions that are too small to characterize
Denominator Exceptions	None
Supporting Guidelines and Other References	The following evidence statements are quoted verbatim from the referenced clinical guidelines and other sources, where applicable: Although most renal masses on unenhanced CT are incompletely characterized, a homogenous lesion between -10 and 20 HU is highly likely to be a benign cyst. (ACR, 2017)[5] Although the majority of lesions are characterized on initial imaging, one definition for the indeterminate renal mass is a lesion containing areas that measure 20-70 Hounsfield units (HU) on noncontrast imaging. Homogenous lesions measuring <20 HU or >70 HU can be considered benign, whereas lesions either entirely or partially within the 20-70 HU range should be considered indeterminate and warrant further evaluation. (ACR, 2015)[6] A homogenous lesion 70 HU or greater on unenhanced CT can confidently be diagnosed as a hyperdense Bosniak II cyst requiring no further characterization or treatment. Further characterization of these masses would add anxiety and cost and is unlikely to alter the diagnosis. (ACR, 2017)[5] The hyperdense cyst can present a diagnostic problem in that its initial attenuation coefficients are high, which can theoretically obscure tiny papillary projections along its wall. However, a homogenous renal mass measuring >70 HU at unenhanced CT has been shown to have a >99.9% chance of representing a high-attenuation renal cyst rather than RCC. (ACR, 2015)[6] Any homogenous renal mass on contrast-enhanced CT between -10 and 20 HU is a benign simple cyst, not requiring further evaluation. (ACR, 2017)[5] For a lesion characterized as a cystic renal mass, that is, one predominantly consisting of

	homogenous round or oval regions without measurable enhancement, we advocate using the Bosniak classification system. Bosniak I and II cystic masses are reliably considered benign and need no follow up. (ACR, 2017)[5] Renal masses with fat attenuation and without calcification are highly likely to be benign AMLs; tiny amounts of fat are only rarely identified in RCC without calcium. Most AMLs are sporadic, and those smaller than 4 cm in an asymptomatic patient can be managed conservatively without surveillance imaging. (ACR, 2017)[5] Although there are no data to suggest how to manage very small (<1 cm) renal masses, some feel that if the lesion in question appears to be a simple cyst—i.e., a low-attenuation (0-20 HU) mass containing no septations, nodularity, calcifications, or enhancement—it can be presumed to be benign and need not be further pursued. (ACR, 2015)[6] <u>Bosniak category I</u> This category is composed of simple cysts that are considered benign. One should remember that the natural history of these cysts is that the majority will grow over time and thus, growth should not necessarily be considered a sign a malignancy. Transformation into a more complex cyst is rare and has been reported in only a handful of cases. As this is rare in occurrence, these cysts do not require followup. ***(Level of evidence: 3; Recommendation: B)*** (CUA, 2017)[7] <u>Bosniak category II</u> These minimally complex cysts are also generally considered benign, but there are reports in the literature of category II lesions being malignant. However, the literature is thought to overestimate the true risk of malignancy among category II cysts, as the majority were managed conservatively or had features that made them too complex to be categorized as a Bosniak II cyst. Importantly, even if malignant, most behave in a relatively benign fashion. Consequently, similar to category I cysts, a followup for properly classified Bosniak II cysts is not warranted ***(Level of evidence: 3; Recommendation: C)*** and intervention is not recommended unless the patient is symptomatic. (CUA, 2017)[7]
Rationale	There exists a significant risk of burden on both the patient and the health system in terms of financial cost, resource use, and increased anxiety when additional imaging of an incidental finding is recommended. These factors should be taken into consideration whenever recommending follow-up imaging, particularly when the likelihood of a benign finding is high, or treatment of a malignant finding would be of minimal benefit. Renal cysts are common incidental findings on abdominal CT and MRI. Because of the increasing use of cross-sectional imaging techniques, this finding is on the rise.[8] Although many of these incidentally-found renal masses are benign,[9] there has been little consensus on follow-up imaging, with 43% of radiologists in one survey recommending a dedicated kidney CT in the final report.[10] In 2017, the American College of Radiology (ACR) outlined certain findings on abdominal CT or MRI suggestive of a benign cyst and for which follow-up is not warranted.[5] There has been a trend of overdiagnosis and overtreatment of small renal tumors.[11] Small incidental renal cysts that are malignant (as in renal cell carcinoma) have often been found to be indolent and nonlethal. It is suggested that surgical interventions for these types of cysts creates a disproportionate and unjustified cost and potential for morbidity, particularly in older patients with co-occurring health problems.[9] This measure aims to minimize recommendations in final reports for follow up imaging for simple-appearing renal incidentalomas that are likely benign or indolent.
Measure Designation	
Measure Purpose	Quality Improvement Accountability

Measure Type	Process
Level of Measurement	Individual Practitioner Group Practice
Care Setting	Ambulatory Inpatient
Improvement Notation	Higher score indicates better quality
National Quality Strategy Priority/CMS Measure Domain	☒ Communication and Care Coordination ☐ Community/Population Health ☒ Effective Clinical Care ☒ Efficiency and Cost Reduction ☒ Patient Safety ☐ Person and Caregiver-Centered Experience

Measure 3: Surveillance Imaging for Liver Nodules < 10 mm in Patients at Risk for Hepatocellular Carcinoma (HCC)

Measure Description	Percentage of final ultrasound reports with findings of liver nodules < 10 mm for patients aged 18 years and older with a diagnosis of hepatitis B or cirrhosis with a specific recommendation for follow-up ultrasound imaging in 3-6 months based on radiological findings
Numerator Statement	Final ultrasound reports with a specific recommendation for follow-up ultrasound imaging in 3-6 months based on radiological findings
Denominator Statement	All final ultrasound reports with findings of liver nodules < 10 mm for patients aged 18 years and older with a diagnosis of hepatitis B or cirrhosis
Denominator Exclusions	Patients with an active diagnosis or history of cancer (except basal and squamous cell skin carcinoma)
Denominator Exceptions	None
Supporting Guidelines and Other References	The following evidence statements are quoted verbatim from the referenced clinical guidelines and other sources, where applicable: Follow-up or additional diagnostic studies to clarify or confirm the impression should be suggested when appropriate. (ACR, 2014)[1] The panel recommends screening with US (every 6 months) and optional AFP testing for patients at risk for HCC. Additional imaging (abdominal multiphasic CT or MRI) is recommended in the setting of a rising serum AFP or following identification of a liver mass nodule 10 mm or greater on US, based on AASLD, OPTN (Organ Procurement and Transplantation Network) and LI-RADS (Liver Imaging Reporting and Data System) guidelines. It is reasonable to screen patients with cross-sectional imaging (CT or MRI) and this is probably the most commonly employed, though not well-studied, method in the United States. Cost and availability may inhibit widespread use of screening using cross-sectional imaging. Liver masses less than 10 mm are difficult to definitively characterize through imaging. If nodules this size are found then US and AFP should be repeated in 3 to 6 months. (NCCN, 2017)[12] For LI-RADS Category US-2 (Subthreshold) observation(s) < 1 cm in diameter, not definitely benign, short-term US surveillance is recommended in 3-6 months. (US LI-RADS v2017)[13]
Rationale	Because of the associated increased risk of developing hepatocellular carcinoma (HCC) in patients with cirrhosis or other chronic liver disease[14], current guidelines recommend surveillance imaging at regular intervals. Patients with cirrhosis receiving this kind of regular screening have been demonstrated to have increased access to transplant, improved survival, and lower mortality.[15,16,17] However, the relative frequency of imaging studies for this population increases the likelihood of benign findings.[18] Many subcentimeter nodules found in a cirrhotic liver are not HCCs[19,18] and should not require immediate intervention or call back for multiphase cross-sectional imaging. Nevertheless, these nodules should continue to be monitored using ultrasound per surveillance imaging protocol for changes in character or growth beyond 10 mm as such changes suggest HCC and warrant further investigation.[19]
Measure Designation	
Measure Purpose	Quality Improvement

	Accountability
Measure Type	Process
Level of Measurement	Individual Practitioner Group Practice
Care Setting	Ambulatory Inpatient
Improvement Notation	Higher score indicates better quality
National Quality Strategy Priority/CMS Measure Domain	☒ Communication and Care Coordination ☐ Community/Population Health ☒ Effective Clinical Care ☒ Efficiency and Cost Reduction ☒ Patient Safety ☐ Person and Caregiver-Centered Experience

Measure 4: Use of Qualitative Assessment Criteria for Follow-Up Oncologic Imaging

Measure Description	Percentage of final reports for all patients, regardless of age, with a diagnosis of cancer undergoing follow-up CT, MR, or PET studies with relevant prior studies available at the time of interpretation that include reference to tumor change and source of criteria to assess tumor change and date and modality of comparison study
Numerator Statement	Final reports that include reference to tumor change and source of criteria to assess tumor change (eg, RECIST 1.1, PERCIST, RANO, Deauville, others) and date and modality of comparison study Examples of criteria used to assess tumor change have been included but do not represent an exhaustive list of major response assessment criteria. The specific source used to determine tumor change is at the discretion of the individual clinician and could also include local or regional sources.
Denominator Statement	All final reports for all patients, regardless of age, with a diagnosis of cancer undergoing follow-up CT, MR, or PET studies with relevant prior studies available at the time of interpretation
Denominator Exclusions	None
Denominator Exceptions	None
Supporting Guidelines and Other References	The following evidence statements are quoted verbatim from the referenced clinical guidelines and other sources, where applicable: The report should use appropriate anatomic, pathologic, and radiologic terminology to describe the findings. (ACR, 2014) [1] Comparison with relevant examinations and reports should be part of the radiologic consultation and report when appropriate and available. (ACR, 2014) [1] The PERCIST 1.0 criteria are intended to represent a framework that can be used for clinical studies, for clinical care, and as a foundation for workshops to refine and validate quantitative approaches to monitoring PET tumor response—approaches that, it is hoped, can be improved and be accepted by the international community and regulatory agencies. (Wahl et al, 2009) [20]
Rationale	Classification of tumor response is important in the evaluation and care of a patient with cancer as it informs the course of ongoing treatment.[21] The use of objective criteria allows all clinicians involved in the care of a patient to share a standardized language when describing any treatment-related change in the tumor. The use of tumor response criteria in oncologic imaging is mostly restricted to clinical trial settings.[21] However, as more novel therapies are approved and become widely available in clinical settings, there is an increased need for radiologists to report their findings in a standardized manner consistent with the mechanism of action of the cancer treatment.[22] Because radiologic imaging is the primary tool used to establish and monitor tumor status, radiologists are poised to assist with the implementation of standardized criteria to monitor tumor change in clinical settings.[22] The purpose of this measure is to encourage radiologists in clinical settings to utilize standardized assessment criteria in oncologic imaging reporting.

Measure Designation	
Measure Purpose	Quality Improvement Accountability
Measure Type	Process
Level of Measurement	Individual Practitioner Group Practice
Care Setting	Ambulatory Inpatient
Improvement Notation	Higher score indicates better quality
National Quality Strategy Priority/CMS Measure Domain	☒ Communication and Care Coordination ☐ Community/Population Health ☒ Effective Clinical Care ☐ Efficiency and Cost Reduction ☐ Patient Safety ☐ Person and Caregiver-Centered Experience

Measure 5: Use of Quantitative Criteria for Follow-up PET Imaging

Measure Description	Percentage of final reports for all patients, regardless of age, with a diagnosis of cancer undergoing whole body FDG PET studies that include at a minimum: a. Serum glucose (eg, finger stick at time of injection) b. Uptake time (interval from injection to initiation of imaging) c. At least one lesional SUV measurement and one reference background (normal structure) uptake measurement (eg, liver or aortic blood pool) **OR** diagnosis of "no disease-specific abnormal uptake"
Numerator Statement	Final reports for whole body FDG PET scans that include at a minimum: a. Serum glucose (eg, finger stick at time of injection) b. Uptake time (interval from injection to initiation of imaging) c. At least one lesional SUV measurement and one reference background (normal structure) uptake measurement (eg, liver or aortic blood pool) **OR** diagnosis of "no disease-specific abnormal uptake"
Denominator Statement	All final reports for all patients, regardless of age, with a diagnosis of cancer undergoing whole body FDG PET studies
Denominator Exclusions	None
Denominator Exceptions	None
Supporting Guidelines and Other References	The following evidence statements are quoted verbatim from the referenced clinical guidelines and other sources, where applicable: The technique section of the report should contain the radiopharmaceutical (eg, 18F-FDG), the administered activity, route and site of administration, as well as any pharmaceuticals administered (eg, diuretics, benzodiazepines). The serum glucose level at the time of radiopharmaceutical administration should be reported as well as patient weight, time from injection to scanning, and technique for calculating SUVs (ie, body weight, lean body weight, or body surface criteria). (ACR, 2016)[23] The findings section should include the location should include description of the location, extent, and intensity of abnormal FDG uptake in relation to normal comparable tissues and should describe the relevant morphological findings on the CT images. Ideally, image and series numbers should also be included. Additionally, background activity (eg, mediastinal blood pool and/or volumetric normal liver) should be measures to help compare SUV values. Often injection-site infiltrates, such as arms, or attenuation-correction errors can significantly alter SUV values in lesions, leading to false conclusions. An estimate of the intensity of FDG uptake can be provided with the SUV; however, the intensity of uptake may be described as mild, moderate, or intense in relation to the background update in normal hepatic parenchyma or the mediastinal blood pool. (ACR, 2016)[23] If the CT scan was requested and performed as a diagnostic examination, the CT component of the examination should be reported separately to satisfy regulatory, administrative, or reimbursement requirements. In that case, the PET/CT report should refer to the diagnostic CT scan report for findings not related to the PET/CT combined findings. Even if the CT scan was not requested as a diagnostic examination, clinically important non-oncologic findings (eg, pneumothorax, aortic aneurysm, bowel obstruction, pneumoperitoneum, fracture) on the CT

	scan should be reported. (ACR, 2016)[23] When PET/CT is performed for monitoring therapy, a comparison of extant and intensity of uptake may be summarized as metabolic progressive disease, metabolic stable disease, metabolic partial response, or metabolic complete response using published criteria for these categories. (ACR, 2016)[23] I. Reporting See also the Society of Nuclear Medicine (SNM) Procedure Guidelines for General Imaging. 1. Study identification 2. Clinical information a. Indication for the study b. Relevant history c. Information needed for billing 3. Procedure description and imaging protocol a. Radiopharmaceutical, including administered activity, route of administration, and 18F-FDG uptake time b. Other drugs administered and procedures performed, such as placement of intravenous line; hydration; insertion of Foley catheter (size of catheter); administration of furosemide (amount and time), muscular relaxants, or pain medications; and sedation procedures (briefly describe the procedure, state the type of medication and time of sedation in relation to the radiotracer injection, and state the patient condition at the conclusion of the PET study) c. Field of view and patient positioning: whole body, skull base to midthigh, or limited area and position of the arms d. Baseline glucose level e. CT transmission protocol (for AC/AL or diagnostic CT protocol with or without oral or intravenous contrast material and with the appropriate protocol for the clinical scenario and body region of interest) f. PET emission protocol: see the Society of Nuclear Medicine Procedure Guidelines for General Imaging (SNMI, 2006)[24] Describe the location, extent, and intensity of abnormal 18F-FDG uptake in relation to uptake in normal comparable tissues and describe the relevant morphologic findings related to PET abnormalities on the CT images. An estimate of the intensity of 18F-FDG uptake can be provided by the SUV; however, the intensity of uptake may be described as mild, moderate, or intense or in relation to the background uptake in normal hepatic parenchyma (average SUV: 2.0–3.0; maximum SUV: 3.0–4.0). (SNMI, 2006)[24]
Rationale	The diagnostic imaging report is the primary vehicle to communicate imaging study results in patients with cancer. Results of imaging studies often play a major role in diagnostic clarification and the development of treatment plans. These reports should be complete and accurate to minimize the risk of diagnosis and treatment based on insufficient or incorrect evidence. Yet, it has been demonstrated that important components of PET studies are often missing from final reports including blood glucose level, SUV measurement, and the time from radiopharmaceutical injection to imaging.[25] Excluding these components may adversely affect comparison with subsequent and prior studies.[26] This measure aims to improve the quality and comparability of final PET reports by ensuring important components are included.
Measure Designation	
Measure Purpose	Quality Improvement Accountability
Measure Type	Process

Level of Measurement	Individual Practitioner Group Practice
Care Setting	Ambulatory Inpatient
Improvement Notation	Higher score indicates better quality
National Quality Strategy Priority/CMS Measure Domain	☒ Communication and Care Coordination ☐ Community/Population Health ☒ Effective Clinical Care ☐ Efficiency and Cost Reduction ☐ Patient Safety ☐ Person and Caregiver-Centered Experience

Measure 6: Radiation Sparing for Patients with Ventricular Shunts

Measure Description	Percentage of patients aged less than 18 years with a ventricular shunt undergoing cranial imaging exams to evaluate for ventricular shunt malfunction undergoing either low dose cranial CT exams or MRI
Numerator Statement	Patients undergoing either low dose cranial CT exams or MRI Definition: For this measure, "low-dose cranial CT" is defined as dose length product (DLP) < 300 mGy for patients aged 2 years and younger; DLP < 405 for patients aged 3 through 6; DLP < 492 for patients aged 7 through 10, DLP < 604 for patients aged 11 through 14, and DLP < 739 for patients aged 15 and up. *Note: The DLP value included within the measure definition is based on the median value for such procedures found within the ACR's Dose Index Registry.*
Denominator Statement	All patients aged less than 18 years with a ventricular shunt undergoing cranial imaging exams to evaluate for ventricular shunt malfunction
Denominator Exclusions	Patients with an active diagnosis or history of cancer (except basal cell and squamous cell skin carcinoma), Patients with a diagnosis of meningitis, Trauma patients
Denominator Exceptions	None
Supporting Guidelines and Other References	The following evidence statements are quoted verbatim from the referenced clinical guidelines and other sources, where applicable: Automated dose reduction techniques available on imaging equipment should be used whenever appropriate. If such technology is not available, appropriate manual techniques should be used. (ACR, 2015)[27] CT examinations should be performed only for a valid medical reason and with the minimum exposure that provides the image quality necessary for adequate diagnostic information. (ACR, 2014)[28] More aggressive dose reduction may be used for examinations that can tolerate higher noise, eg shunt evaluation. (AAPM, 2015)[29]
Rationale	Advances in computed tomography (CT) technology that allow for faster scanning have led to an increase in CT scans as a modality of choice for many indications in children.[30,31] However, studies have also suggested a greater risk of cumulative effects of ionizing radiation in children compared to adults.[32] This risk is of particular concern in children with chronic or complex disorders that require multiple follow up scans, such as VP shunt monitoring in hydrocephalus.[33] It has been demonstrated that patients with shunted hydrocephalus receive an average of 2 head CT scans for surveillance purposes per year.[34] In an effort to mitigate the potential effects of repeated exposure to radiation, low-dose CT protocol studies have been developed and have demonstrated a reduction in radiation dose without the tradeoff of low image quality.[30,35,36,37] However, many facilities do not make adjustments in CT scanning techniques, such as dose reduction, in pediatric patients.[38] Single-sequence MRI has also been demonstrated as a useful technique to rule out VP shunt malfunction.[38] This measure aims to decrease repeated radiation exposure in VP shunt malfunction evaluations by increasing the use of low-dose CT or MRI scans in place of standard head CT scans.

Measure Designation	
Measure Purpose	Quality Improvement Accountability
Measure Type	Process
Level of Measurement	Individual Practitioner Group Practice
Care Setting	Ambulatory Inpatient
Improvement Notation	Higher score indicates better quality
National Quality Strategy Priority/CMS Measure Domain	☐ Communication and Care Coordination ☐ Community/Population Health ☒ Effective Clinical Care ☐ Efficiency and Cost Reduction ☒ Patient Safety ☐ Person and Caregiver-Centered Experience

Measure 7: Radiation Sparing for Patients with Suspicion of Stone Disease

Measure Description	Percentage of patients aged 18 years and older with a diagnosis of urolithiasis or nephrolithiasis undergoing imaging exams of the abdomen or pelvis undergoing only either low-dose CT exams or ultrasound studies of the abdomen or pelvis
Numerator Statement	Patients undergoing only either low-dose CT exams or ultrasound studies of the abdomen or pelvis Definition: For this measure, "low-dose CT" is defined as DLP < 650 mGy *Note: The DLP value included within the measure definition is based on the median value for such procedures found within the ACR's Dose Index Registry.*
Denominator Statement	All patients aged 18 years and older with a diagnosis of urolithiasis or nephrolithiasis undergoing imaging exams of the abdomen or pelvis
Denominator Exclusions	Patients with a BMI of > 35 or equivalent (ie, waist circumference > 88 cm in women and > 102 cm in men); infection; cancer; known acute or chronic renal disease (ie, transplant, creatinine > 1.5 mg/dL, renal insuffiency, polycystic kidney disease, acute kidney failure); patients on anticoagulants; pregnancy; trauma; urologic procedure performed in the past 48 hours
Denominator Exceptions	None
Supporting Guidelines and Other References	The following evidence statements are quoted verbatim from the referenced clinical guidelines and other sources, where applicable: If CT is being performed to evaluate for renal or ureteral stones, a low-dose protocol should be performed (ACR, 2015).[39] Use low-dose CT technique for imaging scenarios such as the evaluation of nephrolithiasis, where fine detail is not needed, or when imaging younger patients <40 years old. (ACR, 2016)[40] Patients who are suspected of having a ureteral stone frequently experience severe flank and occasionally abdominal pain. They desire to have a diagnosis made quickly, receive therapy to relieve symptoms and be informed about the most appropriate management strategies. Therefore, non-contrast CT (NCCT) is the preferred initial imaging study for the index patient (Level A Evidence). (AUA, 2012)[41] Based on a review of the literature, there appears to be consensus that the upper threshold for low-dose CT is 4mSv. Low-dose CT is preferred for patients with a Body Mass Index (BMI) ≤ 30 as this imaging study limits the potential long term side effects of ionizing radiation while maintaining both sensitivity and specificity at 90% and higher. However, low-dose CT is not recommended for those with a BMI > 30 due to lower sensitivity and specificity. (AUA, 2012)[41] Alternative imaging modalities are considered for specific patient groups. Renal ultrasonography (sono) and KUB are a viable option for a known stone former who has previously had radio-opaque stones. (Level C Evidence) (AUA, 2012)[41]

Rationale	This measure is intended to promote the use of a low dose CT protocol or ultrasound when performing diagnostic imaging to identify the presence of renal stones. Preferential use of low or no radiation dose imaging techniques may reduce the risk of adverse outcomes from excessive radiation exposure. Because of its diagnostic accuracy and quick turnaround time, Computed Tomography (CT) has been the modality of choice in 70% of diagnosed kidney stones in the US.[42] However, concerns exist about the administered radiation dose inherent in standard CT examinations, particularly when it is used to diagnose conditions that are often recurrent such as renal stones. Despite the wide availability of CT dose reduction technology, the proportion of kidney stone examinations performed with reduced-dose was found in only 2% of examinations in 2011-2012[43] and remains low at 10% between 2015 and 2016.[42] An alternative modality to consider when evaluating renal colic is ultrasound. One 2014 randomized controlled study comparing US to CT at initial evaluations of suspected nephrolithiasis in the Emergency Department (ED) found no statistically significant differences in return ED visits, hospitalizations, or high-risk diagnoses with complications. The study also demonstrated that although ultrasound is less diagnostically sensitive than CT, ultrasound was sufficient for the purposes of an initial evaluation. Most patients who underwent US did not require further imaging via CT for the sake of diagnostic clarity.[44] The purpose of this measure is to decrease abdomen and pelvis radiation exposure by increasing the use of low-dose CT or ultrasound studies in patients with a diagnosis of urolithiasis or nephrolithiasis with suspicion of stone disease.
Measure Designation	
Measure Purpose	Quality Improvement Accountability
Measure Type	Process
Level of Measurement	Individual Practitioner Group Practice
Care Setting	Ambulatory Inpatient
Improvement Notation	Higher score indicates better quality
National Quality Strategy Priority/CMS Measure Domain	☐ Communication and Care Coordination ☐ Community/Population Health ☒ Effective Clinical Care ☐ Efficiency and Cost Reduction ☒ Patient Safety ☐ Person and Caregiver-Centered Experience

Evidence Classification/Rating Schemes

Canadian Urological Association (CUA) Guideline on the Management of Cystic Renal Lesions, 2017[7]
The level of evidence was summarized according to the following:
Level 1: meta-analysis of randomized, controlled trials (RCTs) or a good-quality RCT;
Level 2: low-quality RCT or meta-analysis of good-quality prospective cohort studies;
Level 3: Good-quality retrospective case-control studies or case series;
Level 4: Expert opinion.
Based on these levels of evidence, we have graded recommendations as follows:
Grade A: consistent with Level 1 evidence;
Grade B: Consistent with Level 2 or 3 evidence;
Grade C: "majority" evidence from Level 2 or 3 studies or level 4 evidence;
Grade D: no recommendation possible or expert opinion without a formal analytic process.

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