American College of Radiology (ACR)

Diagnostic Imaging 2017 - Quality Measures

Developed by ACR's Quality Measures Technical Expert Panel

Status: Final, TEP Approved June 2017

Table of Contents

Disclaimer Notice

Physician Performance Measures (Measures) and related data specifications developed by the American College of Radiology (ACR) are intended to facilitate quality improvement activities by physicians.

These measures are intended to assist physicians in enhancing quality of care. These Measures are not clinical guidelines and do not establish a standard of medical care, and have not been tested for all potential applications. ACR encourages testing and evaluation of its Measures.

Measures are subject to review and may be revised or rescinded at any time by ACR. The measures may not be altered without prior written approval from ACR. The measures, while copyrighted, can be reproduced and distributed, without modification, for noncommercial purposes. Commercial use is defined as the sale, license, or distribution of the measures for commercial gain, or incorporation of the measures into a product or service that is sold, licensed, or distributed for commercial gain. Commercial uses of the measures require a license agreement between the user and ACR. Neither ACR nor its members shall be responsible for any use of the measures.

THESE MEASURES AND SPECIFICATIONS ARE PROVIDED “AS IS” WITHOUT WARRANTY OF ANY KIND.

ACR Quality Measures Technical Expert Panel Members

Co-chairs

Scott MacDonald, MD	David Seidenwurm, MD

TEP Members

Seth Barudin, MD	Jason Itri, MD, PhD
Ari Blitz, MD	Greg Nicola, MD
Marc Bjurlin, DO, MSc	Samir Patel, MD
Jennifer Broder, MD	Daniel B. Rukstalis, MD
Richard Griffey, MD, MPH	Ammar Sarwar, MD
Matt Hawkins, MD	Alexander Towbin, MD
Marta Heilbrun, MD, MS	

ACR Staff	**Project Consultants**
Judy Burleson, MHSA	Yvette Apura, RHIA, PCPI Foundation
Alicia Blakey, MS	Diedra Gray, MPH, PCPI Foundation
Mythreyi Chatfield, PhD	Kerri Fei, MSN, RN, PCPI Foundation
Lu Meyer	Rayna Scott, RHIA, PCPI Foundation
Zachary Smith	Rebecca Swain-Eng, MS, CAE, Independent Consultant
	Sam Tierney, MPH, PCPI Foundation

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: Recommended follow-up for imaging findings

Measure Description	Percentage of final reports for all patients, regardless of age, with follow-up imaging recommended on ultrasound, CT, MRI, PET, or other nuclear medicine studies received in the ambulatory setting that contain an impression or conclusion that includes modalities AND time interval or range for follow-up imaging
Numerator Statement	Final reports that contain an impression or conclusion that includes modalities AND time interval or range for follow-up imaging Numerator Instructions: A short note can be made in the final report, such as: • "Follow-up CT chest without contrast in 6 months, based solely on radiological information" • "Recommend approximately 1 year follow-up pelvic ultrasound per consensus recommendations" (for 6 cm left ovarian cystic lesion with features characteristic of a hemorrhagic cyst) • "Recommend follow-up MRI using a hepatobiliary agent within 3 to 6 months for further evaluation" (for indeterminate liver lesion, which likely represents either hepatic adenoma or focal nodular hyperplasia) • "Consider follow-up CT in 8-12 weeks if symptoms persist" • "Follow-up with either CT or MRI in 6-12 months could be considered"
Denominator Statement	All final reports for all patients, regardless of age, with follow-up imaging recommended on ultrasound, CT, MRI, PET, or other nuclear medicine studies received in the ambulatory setting
Denominator Exclusions	Patients with an active diagnosis or history of cancer (except basal cell and squamous cell skin carcinoma); Lung cancer screening 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: An official interpretation (final report) by the interpreting physician must be generated and archived following any examination, procedure, or officially requested consultation regardless of the site of performance (hospital, imaging center, physician office, mobile unit, etc). (ACR, 2014)[1] The following is [an element of] a suggested format for reporting: 4. Impression (conclusion or diagnosis) a. Unless the report is brief each report should contain an "impression" or "conclusion." b. A specific diagnosis should be given when possible. c. A differential diagnosis should be rendered when appropriate. d. Follow-up or additional diagnostic studies to clarify or confirm the impression should be suggested when appropriate. e. Any significant patient reaction should be reported. (ACR, 2014)[1]

Rationale	Effective communication is a vital component of diagnostic imaging and critical for quality patient care.[1] The written radiology report serves as the key communication vehicle, with an expectation that the results of the imaging exam be shared in a timely, accurate and clear manner including recommendations or suggestions for follow-up imaging when appropriate.[1] Survey data from referring physicians has highlighted the valuable role radiologists' interpretations and recommendations play in patient management and decision making. A recent analysis found that between 84-90% of referring physician respondents relied on radiologists' interpretations of CT and MRI scans all or most of the time.[2] Half of respondents also looked to the radiologist to include recommended next steps in the management of patients in the impressions of their reports.[2] Communication breakdowns occur and are often reported as significant problems in the outpatient and inpatient setting, resulting in medical errors such as missed and delayed diagnosis.[3] Malpractice claims research has found that the second most common cause of litigation is failure to communicate results of radiologic examinations.[4] For imaging studies resulting in recommendations for additional follow-up imaging, this measure aims to improve the guidance given to referring physicians in an effort to promote optimal patient care.
Measure Designation	
Measure Purpose	Quality Improvement
Measure Type	Process
Level of Measurement	Individual Practitioner Group Practice
Care Setting	Ambulatory
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: Appropriateness: Follow-up computed tomography (CT) imaging for incidentally detected pulmonary nodules according to recommended guidelines

Measure Description	Percentage of final reports for CT imaging studies with a finding of an incidental pulmonary nodule for patients aged 35 years and older that contain an impression or conclusion that includes a recommended interval and modality for follow-up (eg, type of imaging or biopsy) or no follow-up and source of recommendations (eg, guidelines such as Fleischner Society, American Lung Association, American College of Chest Physicians)
Numerator Statement	Final reports that contain an impression or conclusion that includes a recommended interval and modality for follow-up (eg, type of imaging or biopsy) or no follow-up and source of recommendations (eg, guidelines such as Fleischner Society, American Lung Association, American College of Chest Physicians)
Denominator Statement	All final reports for CT imaging studies with a finding of an incidental pulmonary nodule for patients aged 35 years and older Definition: CT imaging studies include all studies in which all or part of the thorax can be seen.
Denominator Exclusions	Patients with an active diagnosis or history of cancer (except basal cell and squamous cell skin carcinoma), Patients who are heavy tobacco smokers, Lung cancer screening patients Definition: Patients who are heavy tobacco smokers includes patients with a 30 pack-year tobacco smoking history and currently smoke tobacco or have quit within the past 15 years, consistent with the USPSTF recommendation for lung cancer screening.
Denominator Exceptions	Documentation of medical reason(s) for not including a recommended interval and modality for follow-up or no follow-up and source of recommendations (eg, patients with unexplained fever, immunocompromised patients who are at risk for infection)
Supporting Guidelines and Other References	The following evidence statements are quoted verbatim from the referenced clinical guidelines and other sources, where applicable: Recommendation 1: single solid noncalcified nodules.—Solid nodules smaller than 6 mm (those 5 mm or smaller) do not require routine follow-up in patients at low risk (grade 1C; strong recommendation, low- or very-low-quality evidence). (Fleischner Society, 2017)[5] Solid nodules smaller than 6 mm do not require routine follow-up in all patients with high clinical risk; however, some nodules smaller than 6 mm with suspicious morphology, upper lobe location, or both may warrant follow-up at 12 months (grade 2A; weak recommendation, high-quality evidence). (Fleischner Society, 2017)[5] Solitary noncalcified solid nodules measuring 6–8 mm in patients with low clinical risk are recommended to undergo initial follow-up at 6–12 months depending on size,

	morphology, and patient preference *(*grade 1C: strong recommendation, low- or very-low-quality evidence). (Fleischner Society, 2017)[5] For solitary solid noncalcified nodules measuring 6–8 mm in patients at high risk, an initial follow-up examination is recommended at 6–12 months and again at 18–24 months (grade 1B: strong recommendation, moderate quality evidence). (Fleischner Society, 2017)[5] For solitary solid noncalcified nodules larger than 8 mm in diameter, consider 3-month follow-up, work-up with combined positron emission tomography (PET) and CT (PET/CT), tissue sampling, or a combination thereof; any one of these options may be appropriate depending on size, morphology, comorbidity, and other factors. (grade 1A; strong recommendation, high-quality evidence). (Fleischner Society, 2017)[5] *Recommendation 2: multiple solid noncalcified nodules.*—For multiple solid noncalcified nodules smaller than 6 mm in diameter, no routine follow-up is recommended (grade 2B; weak recommendation, moderate-quality evidence). (Fleischner Society, 2017)[5] For multiple solid noncalcified nodules with at least one nodule 6 mm or larger in diameter, follow-up is recommended at approximately 3–6 months, followed by an optional second scan at 18–24 months that will depend on estimated risk. (grade 1B; strong recommendation, moderate-quality evidence). (Fleischner Society, 2017)[5] *Recommendation 3: solitary pure ground-glass nodules.*—For pure ground-glass nodules smaller than 6 mm (ie, 5 mm and smaller) in diameter, no routine follow-up is recommended (grade 1B; strong recommendation, moderate-quality evidence). (Fleischner Society, 2017)[5] For pure ground-glass nodules 6 mm or larger, follow-up scanning is recommended at 6–12 months and then every 2 years thereafter until 5 years (grade 1B; strong recommendation, moderate-quality evidence). (Fleischner Society, 2017)[5] *Recommendation 4: solitary part solid lung nodules.*—For solitary part solid nodules smaller than 6 mm, no routine follow-up is recommended (grade 1C; strong recommendation, low- or very-low-quality evidence). (Fleischner Society, 2017)[5] For solitary part-solid nodules with a solid component 6 mm or larger, a short-term follow-up CT scan at 3–6 months should be considered to evaluate for persistence of the nodule. For nodules with particularly suspicious morphology (ie, lobulated margins or cystic components), a growing solid component, or a solid component larger than 8 mm, PET/CT, biopsy, or resection are recommended (grade 1B; strong recommendation, moderate quality evidence.) (Fleischner Society, 2017)[5] *Recommendation 5: multiple subsolid lung nodules.*—In patients with multiple subsolid nodules smaller than 6 mm, one must consider infectious causes. If lesions remain persistent after an initial follow-up scan at 3–6 months, consider follow-up at approximately 2 and 4 years to confirm stability, depending on the clinical setting (grade 1C; strong recommendation, low- or very-low-quality evidence). (Fleischner Society, 2017)[5]

	Lung nodules are commonly encountered in the portions of the lungs that are included on CT scans of the neck, heart, and abdomen, and the question often arises as to whether a complete thoracic CT examination should be performed in such instances. For most small nodules (<6 mm), we do not recommend any further investigation on the basis of the estimated low risk of malignancy. For intermediate-size (6–8-mm) nodules, we recommend follow-up CT of the complete chest after an appropriate interval (3–12 months depending on clinical risk) to confirm stability and to evaluate additional findings. If nodule stability can be demonstrated on the basis of retrospective comparison with a previous study, that may suffice. In the case of a large or very suspicious nodule, we recommend proceeding with a complete thoracic CT examination for further evaluation. (Fleischner Society, 2017)
Rationale	With the increasing use of chest computed tomography (CT) imaging comes an increase in the frequency of incidental pulmonary nodule findings.[5] A recent study found that between 2006 and 2012, the annual rate of pulmonary nodule identification in a large, integrated health system increased from 3.9 to 6.6 per 1,000 person-years.[6] The authors estimated that more than 1.5 million adult Americans will have a pulmonary nodule identified each year.[6] These incidental findings require appropriate management to avoid subjecting patients to unnecessary follow-up scans or conversely missing early malignancies. A number of factors contribute to appropriate management decisions for pulmonary nodules, based on estimations of the individual risk of malignancy including nodule size and morphology as well as clinical risk factors.[5] Despite evidence-based recommendations from groups such as the Fleischner society regarding the management and follow-up of small pulmonary nodules detected incidentally, various studies[7,8,9,10] have documented low rates of adherence. For example, one recent study found that 44.7% of patients received care inconsistent with the Fleischner society recommendations (17.8% overevaluation, 26.9% underevaluation).[10] This measure aims to encourage the use of an evidence-based approach in recommending follow-up imaging for incidental pulmonary nodules.
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: Appropriate follow-up imaging for benign adrenal masses

Measure Description	Percentage of final reports for patients aged 18 years and older with a finding of an incidental adrenal mass on CT or MRI imaging studies received in the ambulatory and inpatient settings that are either ≤ 1.0 cm or classified as likely benign by unenhanced CT or washout protocol CT, or MRI with in- and opposed-phase sequences or other equivalent institutional imaging protocols describing an incidentally detected benign-appearing adrenal mass with a specific recommendation for no follow-up imaging based on radiological findings
Numerator Statement	Final reports describing an incidentally detected benign-appearing adrenal mass with a specific recommendation for no follow-up imaging based on radiological findings Numerator Instructions: A short note can be made in the final report, such as: • "No follow-up imaging is recommended based on radiologic consensus recommendations" (for 2cm lipid-rich left adrenal adenoma) • "No follow-up imaging is necessary per consensus recommendations based on imaging criteria. Further lab evaluation could be pursued based on clinical findings" (for 1.5 cm left adrenal nodule has been stable for 2 years and is likely benign)
Denominator Statement	All final reports for patients aged 18 years and older with a finding of an incidental adrenal mass on CT or MRI imaging studies received in the ambulatory and inpatient settings that are either: ≤ 1.0 cm OR classified as likely benign by unenhanced CT or washout protocol CT, or MRI with in- and opposed-phase sequences or other equivalent institutional imaging protocols Definition: CT or MRI imaging studies include all studies that include the adrenal gland.
Denominator Exclusions	Patients with an active diagnosis or history of cancer (except basal cell and squamous cell skin carcinoma), Patients with other metabolic disorders (renal vascular hypertension, renal tubular acidosis, others), Patients with adrenal lesions > 4 cm
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 an adrenal mass has diagnostic features of a benign lesion such as a myelolipoma (presence of macroscopic fat) or cyst (simple cyst-appearing without enhancement), no additional workup or follow-up imaging is needed. If the lesion is 1 to 4 cm and has a density of ≤10 HU on CT or signal loss compared with the spleen on out-of-phase images of a chemical-shift MRI (CS-MRI) examination, it is almost always diagnostic of a lipid-rich adenoma. If diagnostic imaging features are not present but the adrenal mass has been stable for ≥1 year, it is likely benign. (ACR, 2010)[11]

	Note: This measure ultimately will be based on newer and more specific guidance to be described in a forthcoming ACR Incidental Findings Committee white paper on management of incidental adrenal masses. While this paper is not available at the time of the measure set public comment period, publication is expected in the coming months and prior to finalization of the measure.
Rationale	Adrenal incidentalomas are commonly found during abdominal imaging studies, with incidence rates ranging from approximately 4% in radiologic series to 8% in autopsy series.[12] The vast majority of these adrenal masses are benign in patients without known malignancies and many, such as myelolipoma or cysts, include distinct features that result in a specific benign diagnosis without the need for further imaging.[12] For such patients, follow-up is not recommended and unnecessary follow-up procedures may present a significant psychologic and financial burden.[13] Research has demonstrated considerable variability among radiologists in the management of incidental findings. A 2011 survey conducted by Johnson et al. found significant variability in how radiologists report and manage incidental findings including an agreement rate of 63% among participating radiologists for adrenal findings.[14] This measure is intended to encourage radiologists to communicate appropriate recommendations for no further follow-up imaging for patients with incidentally identified adrenal masses less than or equal to 1 cm OR classified as benign. This measure incorporates the adrenal lesion component of the existing ACR measure, Appropriate follow-up imaging for incidental abdominal lesions, which will subsequently be modified to exclude adrenal lesions
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: Interpretation of CT pulmonary angiography (CTPA) for pulmonary embolism (PE)

Measure Description	Percentage of final reports for patients aged 18 years and older undergoing CT pulmonary angiography (CTPA) with a finding of PE that specify the branching order level of the most proximal level of embolus (ie, main, lobar, interlobar, segmental, subsegmental)
Numerator Statement	Final reports that specify the branching order level of the most proximal level of embolus (ie, main, lobar, interlobar, segmental, subsegmental)
Denominator Statement	All final reports for patients aged 18 years and older undergoing CT pulmonary angiography (CTPA) with a finding of PE
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: Normal CT angiography safely excludes PE in patients with low or intermediate clinical probability or PE-unlikely. (Class I Recommendation; Level of Evidence A) (ESC, 2014)[15] Normal CT angiography may safely exclude PE in patients with high clinical probability or PE -likely. (Class IIa Recommendation; Level of Evidence B) (ESC, 2014)[15] CT angiography showing a segmental or more proximal thrombus confirms PE. (Class I Recommendation; Level of Evidence B) (ESC, 2014)[15] Further testing to confirm PE may be considered in case of isolated sub-segmental clots. (Class IIb Recommendation; Level of Evidence C) (ESC, 2014)[15]
Rationale	CT pulmonary angiography (CTPA) is the preferred imaging choice for the evaluation and diagnosis of pulmonary embolism.[16] Identification of the embolus as well as providing documentation on the location of the embolus drive ultimate treatment decisions.[17,18] A retrospective analysis of CTPA reports[19] found that out of 2151 consecutive reports, 8% of those were conclusively positive for PE, but do not seem to mention specifics regarding the location of the PE. However, 27% of reports that were negative for PE had documentation that results were conclusively negative down to the segmental artery. While not yet clearly demonstrated, there is room to improve the documentation related to conclusively positive PE results via CTPA. This measure is intended to drive improvement in final report documentation to facilitate decision making and care management by the referring physician.
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: Incidental coronary artery calcification reported on chest CT

Measure Description	Percentage of final reports for male patients aged 18 years through 50 and female patients aged 18 through 65 years undergoing noncardiac noncontrast chest CT exams or with and without contrast chest CT exams that note presence or absence of coronary artery calcification or not evaluable
Numerator Statement	Final reports that note presence or absence of coronary artery calcification or not evaluable Numerator Instructions: A short note can be made in the final report, such as: • "Coronary artery calcification absent" • "Definite coronary artery calcification is present" • "No convincing coronary artery calcification seen"
Denominator Statement	All final reports for male patients aged 18 years through 50 and female patients aged 18 through 65 years undergoing noncardiac noncontrast chest CT exams or with and without contrast chest CT exams
Denominator Exclusions	Patients who have received prior coronary artery bypass grafts or prior percutaneous coronary intervention with stent
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: [Coronary Artery Calcium (CAC)] should be evaluated and reported on all noncontrast chest CT examinations (Class I Recommendation) (SCCT/STR, 2016)[20]
Rationale	Coronary artery calcium scoring predicts cardiovascular risk. While patients undergoing noncardiac chest CTs are not undergoing an evaluation for coronary artery calcium scoring, there are cases where coronary artery calcifications are found. Studies have shown that these incidental findings have value and can be used to stratify patient cardiovascular risk based on findings in conjunction with patient history, which can lead to improved prognosis and outcome. [21,22,23] Documentation of the presence of coronary artery calcium on noncardiac chest CTs is often underreported in radiology reports, even though primary physicians would likely use this information to inform treatment decisions.[24] In a retrospective review of non-gated noncontrast chest CTs, researchers found approximately one-third of the time, the presence of coronary artery calcium was not documented, even though it was present on the chest CT.[25] This measure aims to improve the communication of CAC findings to referring physicians to improve patient's cardiovascular care management.
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

Guidelines for Management of Incidental Pulmonary Nodules Detected on CT Images: From the Fleischner Society 2017[5]

Ratings of each recommendation were graded using the American College of Chest Physicians recommendations for evidence grading in clinical guidelines

ACCP Grading Recommendations from Guyatt et al., 2006[26]

Grade of Recommendation/ Description	Benefit vs Risk and Burdens	Methodological Quality of Supporting Evidence	Implications
1A/strong recommendation, high-quality evidence	Benefits clearly outweigh risk and burdens, or vice versa	RCTs without important limitations or overwhelming evidence from observational studies	Strong recommendation, can apply to most patients in most circumstances without reservation
1B/strong recommendation, moderate quality evidence	Benefits clearly outweigh risk and burdens, or vice versa	RCTs with important limitations (inconsistent results, methodological flaws, indirect, or imprecise) or exceptionally strong evidence from observational studies	Strong recommendation, can apply to most patients in most circumstances without reservation
1C/strong recommendation, low-quality or very low-quality evidence	Benefits clearly outweigh risk and burdens, or vice versa	Observational studies or case series	Strong recommendation but may change when higher quality evidence becomes available
2A/weak recommendation, high-quality evidence	Benefits closely balanced with risks and burden	RCTs without important limitations or overwhelming evidence from observational studies	Weak recommendation, best action may differ depending on circumstances or patients' or societal values
2B/weak recommendation, moderate-quality evidence	Benefits closely balanced with risks and burden	RCTs with important limitations (inconsistent results, methodological flaws, indirect, or imprecise) or exceptionally strong evidence from observational studies	Weak recommendation, best action may differ depending on circumstances or patients' or societal values
2C/weak recommendation, low-quality or very low-quality evidence	Uncertainty in the estimates of benefits, risks, and burden; benefits, risk, and burden may be closely balanced	Observational studies or case series	Very weak recommendations; other alternatives may be equally reasonable

2014 ESC Guidelines on the Diagnosis and Management of Acute Pulmonary Embolism

Classes of recommendations[22]

Class I Evidence and/or general agreement that a given treatment of procedure is beneficial, useful, effective

Class II Conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of the given treatment or procedure

Class IIa Weight of evidence/opinion is in favour of usefulness/efficacy

Usefulness/efficacy is less well established by evidence/opinion

Class III Evidence or general agreement that the given treatment or procedure is not useful/effective and in some cases may be harmful

Levels of evidence

Level A Data derived from multiple randomized clinical trials or meta-analyses

Level B Data derived from a single randomized clinical trial or large non-randomized studies

Level C Consensus of opinion of the experts and/or small studies, retrospectives studies, registries

References

[1] American College of Radiology. ACR practice parameter for communication of diagnostic imaging findings (revised 2014). Available at: https://www.acr.org/~/media/C5D1443C9EA4424AA12477D1AD1D927D.pdf. Accessed March 24, 2017.

[2] Jones J. Imaging 3.0 Case Study: Survey Says... Available at: https://www.acr.org/Advocacy/Economics-Health-Policy/Imaging-3/Case-Studies/Strategic-Planning/Survey-Says. Accessed April 17, 2017.

[3] Murphy DR, Singh H, Berlin L. Communication breakdowns and diagnostic errors: a radiology perspective. Diagnosis (Berlin, Germany). 2014;1(4):253-261.

[4] Berlin L. Failure of radiologic communication: An increasing cause of malpractice litigation and harm to patients. Applied Radiology. 2010 Jan 1;39(1-2):17-23.

[5] MacMahon H, Naidich DP, Goo JM, et al. Guidelines for Management of Incidental Pulmonary Nodules Detected on CT Images: From the Fleischner Society 2017. Radiology. 2017 Feb 23:161659.

[6] Gould MK, Tang T, Liu IL, et al. Recent trends in the identification of incidental pulmonary nodules. Am J Respir Crit Care Med 2015;192(10):1208–1214.

[7] Eisenberg RL, Bankier AA, Boiselle PM. Compliance with Fleischner Society Guidelines for Management of Small Lung Nodules: A Survey of 834 Radiologists. Radiology 2010; 255:1, 218-224

[8] Esmaili A, Munden RF, Mohammed TH. Small Pulmonary Nodule Management: A Survey of the Members of the Society of Thoracic Radiology With Comparison to the Fleischner Society Guidelines. J Thorac Imaging. 2011 Feb;26(1):27-31.

[9] Lacson R, Prevedello LM, Andriole KP, et al. Factors associated with radiologists' adherence to Fleischner Society guidelines for management of pulmonary nodules. J Am Coll Radiol. 2012 Jul;9(7):468-73.

[10] Wiener RS, Gould MK, Slatore CG, Fincke BG, Schwartz LM, Woloshin S. Resource Use and Guideline Concordance in Evaluation of Pulmonary Nodules for Cancer: Too Much and Too Little Care. *JAMA Intern Med.* 2014;174(6):871-880.

[11] Berland LL, Silverman SG, Gore RM, et al. Managing incidental findings on abdominal CT: white paper of the ACR incidental findings committee. J Am Coll Radiol. 2010 Oct;7(10):754-73.

[12] Kapoor A, Morris T, Rebello R. Guidelines for the management of the incidentally discovered adrenal mass. Canadian Urological Association Journal. 2011;5(4):241-247. doi:10.5489/cuaj.11135.

[13] Casarella WJ. A patient's viewpoint on a current controversy. Radiology. 2002;224(3):927.

[14] Johnson PT, Horton KM, Megibow AJ, Jeffrey RB, Fishman EK. Common incidental findings on MDCT: survey of radiologist recommendations for patient management. J Am Coll Radiol. 2011 Nov;8(11):762-7.

[15] Konstantinides SV, Torbicki A, Agnelli G, et al.; Task Force for the Diagnosis and Management of Acute Pulmonary Embolism of the European Society of Cardiology (ESC). 2014 ESC guidelines on the diagnosis and management of acute pulmonary embolism. Eur Heart J. 2014 Nov 14;35(43):3033-69, 3069a-3069k. doi: 10.1093/eurheartj/ehu283. Epub 2014 Aug 29.

[16] The Task Force for the Diagnosis and Management of Acute Pulmonary Embolism of the European Society of Cardiology (ESC). 2014 ESC guidelines on the diagnosis and management of pulmonary embolism. European Heart Journal. 2014;35:3033-3080.

[17] Doğan H, de Roos A, Geleijins J, Huisman MV, Kroft LJM. The role of computed tomography in the diagnosis of acute and chronic pulmonary embolism. Diagn Interv Radiol. 2015;21:307-316.

[18] Vedovati, MC, Germini F, Agnelli G, Becattini C. Prognostic role of embolic burden assessed at computed tomography angiography in patients with acute pulmonary embolism: systematic review and meta-analysis. Journal of Thrombosis and Haemostasis. 2013;11:2092-2102.
[19] Abujudeh HH, Kaewlai R, Farsad K, Orr E, Gilman M, Shepard JO. Computed tomography pulmonary angiography: an assessment of the radiology report. Acad Radiol. 2009;16:1309-1315
[20] Hecht HS, Cronin P, Blaha MJ, et al. 2016 SCCT/STR guidelines for coronary artery calcium scoring of noncontrast noncardiac chest CT scans: A report of the Society of Cardiovascular Computed Tomography and Society of Thoracic Radiology. J Cardiovasc Comput Tomogr. 2017 Jan - Feb;11(1):74-84. doi: 10.1016/j.jcct.2016.11.003. Epub 2016 Nov 10.
[21] Xie X, Zhao Y, deBock GH, Jong PA, Mali WP, Oudkerk M, Vliegenthart R. Validation and prognosis of coronary artery calcium scoring in nontriggered thoracic computed tomography. Circ Cardiovasc Imaging. 2013;6:514-521.
[22] Jairam PM, Gondrie MJA, Grobbee DE, Mali WP, Jacobs PCA, van der Graaf Y. Incidental imaging findings from routine chest CT used to identify subjects at high risk of future cardiovascular events. Radiology. 2014;3:700-708.
[23] Chiles C, Duan F, Gladish GW, Ravenel JG, Baginski SG, Snyder BS, et al. Association of coronary artery calcification and mortality in the national lung screening trial: A comparison of three scoring methods. Radiology. 2015;276:82-90.
[24] Uretsky S, Chokshi N, Kobrinski T, Agarwal SK, Po JR, Awan H, et al. The interplay of physician awareness and reporting of incidentally found coronary artery calcium on the clinical management of patients who underwent noncontrast chest computed tomography. Am J Cardiol. 2015;115:1513-1517.
[25] Balakrishan R, Nguyen B, Raad R, Donnino R, Naidich DP, Jacobs JE, Reynolds HR. Coronary artery calcification is common on nongated chest computed tomography imaging. Clin Cardiol. 2017. https://doi.org/10.1002/clc.22685.
[26] Guyatt G, Gutterman D, Baumann MH, et al. Grading strength of recommendations and quality of evidence in clinical guidelines: report from an American College of Chest Physicians task force. Chest 2006;129(1):174–181.