

Actionable Findings and the Role of IT Support: Report of the ACR Actionable Reporting Work Group

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The ACR formed the Actionable Reporting Work Group to address the potential role of IT in the communication of imaging findings, especially in cases that require nonroutine communication because of the urgency of the findings or their unexpected nature. These findings that require special communication with referring clinicians are classified as “actionable findings.” The work group defines 3 categories of actionable findings that require, respectively, communication and clinical decision within minutes (category 1), hours (category 2), or days (category 3). Although the work group does not believe that there can be definitive lists of such findings, it developed lists in each category that would apply in most general hospital settings. For each category, the work group discusses ways in which IT can assist interpreting radiologists in successfully communicating to the relevant clinicians to ensure optimal patient care. IT systems can also help document the communication and facilitate auditing of the documentation. The work group recommends that vendors develop platforms that can be customized on the basis of local preferences and needs. Whatever system is used, it should be highly reliable and fit seamlessly into radiologists’ workflow.

Key Words: Actionable findings, actionable reporting, communication, critical findings, critical results, decision support, incidental findings, information technology, Joint Commission, unexpected findings

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FOREWORD

This paper is not intended to establish formal guidelines or recommendations for the categorization of actionable findings or methods of communication. The categories of findings listed herein are for illustration only and are not intended to be definitive. Rather, this paper represents the collective experience and viewpoints of members of the ACR Actionable Reporting Work Group and is presented as support for local practices in their efforts to develop such categories and processes. The ultimate judgment regarding any specific course of action must be made by the physician involved, with particular knowledge of the condition of the patient and the practice environment. For these reasons, this paper

should not be used to establish the legal standard of care in any particular situation.

INTRODUCTION

The official radiology interpretation (“final report”) remains the definitive record of an imaging examination, as specified in the ACR Practice Guideline for Communication of Diagnostic Imaging Findings [1]. However, the urgency of imaging findings may require additional, nonroutine communication. In other situations, unexpected findings or important observations may not require immediate action, but the radiologist may want to ensure that the referring clinician has received and understood the findings. Findings that are discrepant with a preceding interpretation also require appropriate communication. Mechanisms developed to communicate initial findings may be helpful in reporting and tracking discrepant findings. All such findings that require special communication with the referring clinician are classified here as “actionable findings.”

An important part of the ACR’s Imaging 3.0TM initiative is standardized communication [2]. The ACR seeks a lead role in developing systems and protocols for

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standardized reporting. Communication of findings to referring clinicians has been recognized as an important role and duty of radiologists [3,4], and failure to appropriately communicate findings has been recognized as a leading cause of malpractice action against radiologists and referring clinicians [5]. To improve the processes for reporting actionable findings, the ACR formed the Actionable Reporting Work Group within the Commission on Quality and Safety. This work group explored the various categories of such findings and the ways in which information systems could facilitate and document such communication.

The ACR's goals are consonant with The Joint Commission's (TJC) National Patient Safety Goal NPSG.02.03.01, "Report critical results of tests and diagnostic procedures on a timely basis" [6,7]. Accredited facilities are required by TJC to define critical tests and critical results and to monitor their performance in reporting those results. Although initially developed for laboratory medicine, these concepts have been extended to imaging examinations. A critical result has been defined as "any result or finding that may be considered life threatening or that could result in severe morbidity and require urgent or emergent clinical attention." Critical tests are those that "require rapid communication of results, whether normal, abnormal, or critical" [8]. Each facility has leeway to define its own critical tests and critical results, and thus there is no standard list for either category.

The work group believes that actionable imaging findings can be divided reasonably into 3 categories. These categories are defined primarily by their levels of urgency, which is also related to the severity of the findings. Each category may require a different method of nonroutine communication. The type of IT support that would assist interpreting radiologists also may vary among the categories.

CATEGORIES OF FINDINGS

Different authors and institutions have taken widely variable approaches to nomenclature. The specific names of the categories are less important than the concepts behind them. The Massachusetts Coalition for the Prevention of Medical Errors has used "red," "orange," and "yellow" categories of urgency [9]. Terms such as *critical*, *urgent*, *significant*, *incidental*, and *unexpected* have been used to describe various categories of findings, but these terms have not been applied uniformly across all institutions or information systems. The ACR practice guideline does not attempt to specifically define such categories, but it does put emphasis on "findings that suggest a need for immediate or urgent intervention," which would correspond to the more urgent or important categories in the other nomenclatures. The work group believes that descriptive terms as listed above may cause more confusion than clarity and elects not to suggest such terms. Thus, the work group defines 3 categories of actionable findings that require, respectively, communication

and clinical decision within minutes (category 1), hours (category 2), or days (category 3).

The suggested timing of nonroutine communication should not be confused with the timing of reporting. The work group supports reporting all cases as promptly as practical, whether or not there are actionable findings. This distinction between communication and reporting is particularly relevant in category 3. Although the final report will often be available within minutes or hours, the purpose of nonroutine communication in these cases is to ensure that the report has been reviewed by the appropriate clinician(s) and the important finding(s) appreciated.

Category 1: Communication Within Minutes

Category 1 findings are those that could lead to death or significant morbidity if not promptly recognized, communicated, and acted upon. Direct verbal communication to the ordering clinician is generally required as promptly as possible. Documentation of the communication may be required by local policy or TJC requirements.

The work group surveyed its members and searched the literature for lists of critical or urgent findings. Not surprisingly, there was variability in the length and content of the lists. The work group does not believe that there can be a single definitive list of such findings, but it has developed a list (see the [Appendix](#)) that would apply in most general hospital settings and could be adopted "as is" or modified locally. The prevalence of such findings may vary greatly among institutions on the basis of their patient populations and the expertise of their medical staff members, and the list at a given institution should reflect such variables. Furthermore, whatever the list, radiologists should always use their judgment and treat similarly important findings that are not on the list in the same manner when required for optimal patient care.

The work group further suggests that TJC critical results should be a subset of this category. Because TJC critical results have specific documentation and tracking requirements, institutions may choose to designate a number of category 1 findings as critical results to comply with these requirements. Those critical results should reflect some of the most prevalent and serious findings at the specific institution. Because the TJC critical results would be communicated in the same manner as the other category 1 findings, it would be reasonable to assume that the less common findings would be communicated and documented in the same manner as the critical results. For those institutions that desire guidance on critical results, the work group developed a list of suggested findings on the basis of frequency of citation from the sources reviewed (see [Table 1](#)) that can be used as critical results for TJC purposes.

Category 2: Communication Within Hours

Category 2 findings are clinically significant observations that generally explain a patient's acute presentation and require specific medical or surgical treatment,

Table 1. Suggested critical results for The Joint Commission

Ectopic pregnancy
Intracranial hemorrhage
Pulmonary embolus
Ruptured/leaking aortic aneurysm
Severe spinal cord compression
Significant misplacement of tubes or catheters
Tension pneumothorax
Testicular/ovarian torsion
Unexplained pneumoperitoneum
Unstable spine fracture

Note: Results are listed alphabetically; no priority should be implied.

but they do not have the same urgency and severity as those in category 1. In many cases, these findings will be communicated in the same manner as those in category 1, but other mechanisms, such as a promptly available finalized report, a preliminary report sent by secure fax, a phone message, and perhaps other mechanisms as defined locally, may be sufficient. The referring provider will often be expecting to receive the results promptly, which may help ensure their receipt if the results are not directly communicated. Many of these cases will come from the emergency department, where there may be well-defined methods of communication, and in outpatient cases, the referring clinician will often have requested expedited communication. However, the radiologist should ensure that the results were received, understood, and acted upon appropriately.

It is even more difficult to develop a list of findings in category 2 than in category 1, and there are no regulatory requirements such as TJC critical results to drive the process. (See the [Appendix](#) for a suggested list of these findings.) Additionally, there are findings that fall into a gray zone of severity such that a finding that falls into category 1 at one institution may be considered more appropriate for category 2 at another institution. Likewise, a finding that one institution would place in category 2 might be considered routine at another institution and not requiring of any special attention.

Category 3: Communication Within Days

Category 3 findings generally do not require any immediate treatment or other action, but in the long term, they could be very significant. These are often referred to as “incidental” or “unexpected.” Many of these findings will require follow-up imaging but, in some cases, not for many months. Because they are often unexpected by the ordering provider and often incidental to the primary purpose of the imaging examination, there is a greater risk of the findings being overlooked than when there is an acute finding that explains a patient’s presenting clinical complaints. In some cases, the provider responsible for following up on a finding will not be the same person who ordered the study. This is particularly true for patients presenting

through the emergency department. The identity of the provider who will be responsible for follow-up may not even be known at the time of the examination, and therefore that provider may not receive a copy of the imaging report. For these reasons, category 3 findings present a significant risk to patients of failure to receive appropriate care or follow-up.

Examples in category 3 can range from a definitive diagnosis of a new malignancy to a questionable finding that may or may not even be real and, if real, may be more likely benign than malignant. (See the [Appendix](#) for a suggested list of these findings.)

IT SUPPORT BASED ON CATEGORIES OF FINDINGS

Category 1: Communication Within Minutes

Because these findings will usually be directly communicated to a clearly identified ordering provider, there is a limited role for IT in communication in this category. However, IT systems can help ensure that accurate information is available to promptly contact the provider. Particularly at larger institutions, it may be difficult to accurately identify the current or lead caregivers, and IT systems may be able to help identify and locate the appropriate provider with whom to communicate. Additionally, the IT system might be able to prompt the radiologist through use of natural language processing that a specific diagnosis falls into category 1 or is a locally designated TJC critical result to ensure that proper protocols are followed and that communication is documented in the appropriate manner. The system could also track category 1 cases, including those cases designated as TJC critical results, to ensure documentation of communication and to facilitate auditing of the documentation process.

Category 2: Communication Within Hours

Because these findings will not always be communicated directly, the information system could provide a mechanism for referring providers, and possibly for consultants such as surgeons, to acknowledge that they have received the reports. Perhaps this could be taken one step further with a field or drop-down menu to briefly indicate the immediate treatment plans for the patient as a method of documenting comprehension of the findings. As with category 1 findings, having accurate information to promptly contact the ordering provider would be an important contribution from the information system.

Category 3: Communication Within Days

This category has the most need and potential for IT support. The challenges facing the interpreting radiologist are many and varied. Also, because the findings in question are often not immediately important to patient care, the radiologist may need to move on to the

interpretation of other, more urgent studies as quickly as possible. This increases the risk that a finding will “fall through the cracks.”

For a potentially important nonurgent or incidental finding, the radiologist should try to ensure that the result is received and recognized by the appropriate provider, who may not be clearly identified or known at the time. The optimal method to accomplish this may vary. For example, it would not be appropriate to interrupt a physician performing surgery or another procedure to discuss a possible lung nodule found on a chest radiograph, and even interrupting an office visit to provide such information may be an unwanted and unnecessary intrusion. Furthermore, such communication may not be the most effective way to ensure appropriate management.

It may be unclear when a finding is truly “unexpected,” and when uncertain, the radiologist may want to ensure adequate communication of such findings. For example, when part of the clinical question for an imaging examination is essentially “rule out cancer,” is the finding of a likely cancer an unexpected finding? Even if it is considered “expected,” the radiologist may be well advised to ensure receipt and understanding to ensure optimal patient care.

From the standpoint of the radiologist, it would be ideal if the final report alone would suffice to communicate the information and associated recommendations. In most cases in category 3, it is not necessary for the responsible provider to receive the information immediately. A delay of several days or even 1 or 2 weeks may be acceptable when the provider is not immediately available. However, if the radiologist does not make prompt contact with the provider, he or she will not be able to document communication in the report of the examination, and the case may be rapidly forgotten as other cases are interpreted.

An IT solution could allow the radiologist to issue the final report in a standard manner but flag it as containing important but nonurgent findings, which should be highlighted from the other less important or more obvious findings. The system could then require the provider receiving the report to acknowledge receipt and perhaps to note treatment or follow-up plans. This communication could be documented and an automated addendum made to the final report. In the event that the provider did not acknowledge the report in a timely manner, the interval of which might be customizable, the system would generate a regularly scheduled report of all such cases to a designated person, who would then follow-up with the provider.

When a follow-up imaging examination is needed, the system might also facilitate scheduling a follow-up examination or generate follow-up communication to the provider and/or patient at a time closer to the projected follow-up examination. Such reminder systems are well established in breast imaging, and vendors and institutions could use this experience to develop such systems.

DISCUSSION

Nonroutine communication of imaging findings presents a variety of challenges for interpreting radiologists and for the providers receiving the reports of imaging examinations. Fortunately, advances in IT capabilities can provide options to ease the burden on all parties involved and can facilitate improved communication and patient care. Commercial developers of PACS, reporting systems, and electronic medical record systems may be interested in and capable of providing solutions to the various problems inherent in reporting and communicating imaging findings.

Although radiologists and product vendors might prefer a single solution that would work in all settings, the reality is that a “one size fits all” model may not be feasible or in the best interests of optimal patient care. The ACR Actionable Reporting Work Group recommends that vendors develop platforms that can be customized on the basis of local preferences and needs. The lists developed by the work group could be used as is or modified by moving findings among the categories, adding other findings that are of local importance, and deleting findings that are unlikely to arise in their local setting. Critical results designated for compliance with TJC requirements could be highlighted in a longer list of category 1 results. Even the names of the categories could be modified for local preference. One of the most important contributions of such systems would be to facilitate and document communication of findings to referring and treating providers, to ensure comprehension of the findings, and to ensure and facilitate proper follow-up.

Whatever system is used, it should be highly reliable and fit seamlessly into radiologists’ workflow. Ideally, the documentation of nonstandard communication should use a single system to ensure optimal tracking and auditing. Administrative personnel should have one place where all cases are logged and any outstanding reports are easily identified. This could be as simple as a paper logbook or as complex as a powerful computerized notification and tracking system. The key is that the system be reliable, trusted, and used consistently by every radiologist, following an accepted and clearly understood protocol.

There is a great opportunity for radiologists and vendors to develop and refine information systems to optimize communication of all imaging findings, especially when nonroutine communication of actionable findings is required and when long-term follow-up imaging is indicated.

TAKE-HOME POINTS

- Communication of findings is an important role of radiologists but can present a variety of challenges, particularly when “actionable findings” require non-routine communication.

- IT can facilitate nonroutine communication of imaging findings to the appropriate provider(s) who will be responsible for immediate treatment and/or follow-up care of patients.
- IT can facilitate documentation of nonroutine communication of imaging findings.
- The method of nonroutine communication of imaging findings can vary with the urgency and severity of the findings.
- IT systems developed to facilitate communication should be customizable on the basis of local needs and should fit seamlessly into radiologists' workflow.

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APPENDIX

These findings have been placed into 3 categories of urgency under the assumption that they are known or suspected to be new findings or are known to have significantly worsened since a prior study. A stable finding that was previously known and appropriately communicated may not require additional nonroutine communication despite the severity of the disease process.

	Category 1: Communicate Within Minutes	Category 2: Communicate Within Hours	Category 3: Communicate Within Days
General	<ul style="list-style-type: none"> • Suspected nonaccidental trauma • Malpositioned line or tube of immediate clinical concern (eg, ET tube or enteric tube in bronchus) • Allergic reaction or other adverse event resulting in a code • Foreign body with potential immediate and/or severe consequences • Any finding that the interpreting radiologist determines requires immediate physician notification 	<ul style="list-style-type: none"> • Clinically significant mass, tumor, or infection • Finding highly suggestive of malignancy • Intravascular line in suboptimal location, moderate risk (eg, intended central line in jugular or azygous vein, right atrium) • Retained surgical instruments, sponges, devices • Misplaced or migrated surgical or other implanted devices (eg, IVC filter, gastric band, pacemaker wires) • Adverse event from diagnostic imaging or interventional procedure • Significant congenital anomaly 	<ul style="list-style-type: none"> • Probable malignancy, any location, no acute danger to patient • Significant nonmalignant diagnosis, any location, no acute danger to patient • Incidental finding on imaging study requiring further workup or longer term follow-up
Neurologic/ head and neck	<ul style="list-style-type: none"> • Intracranial or spinal hemorrhage (parenchymal, subarachnoid, subdural, epidural) • Nonhemorrhagic stroke or suspected stroke, thrombolytic candidate • Intracranial mass with significant mass effect (midline shift/herniation/hydrocephalus) • Brain herniation • Symptomatic hydrocephalus (malfunctioning shunt or new diagnosis of any cause) • Depressed skull fracture • Post-traumatic pneumocephalus • Arterial dissection • Brain death (nuclear study or other) • Severe spinal cord compression of any cause • Unstable spine fracture • Cord hemorrhage or infarct • Airway obstruction or impending obstruction (epiglottitis, retropharyngeal abscess, tonsillitis, facial fracture, other) 	<ul style="list-style-type: none"> • Critical arterial stenosis or occlusion • Nonruptured intracranial aneurysm • Intracranial mass without significant mass effect (no midline shift/herniation) • Nonhemorrhagic stroke, not thrombolytic candidate • Linear skull fracture • Facial fracture, no airway compromise, likely to need surgical repair • Stable spinal fracture without cord compression • Spinal mass without cord compression • Spinal cord edema • Discitis • Airway narrowing, not severely obstructive • Abscess, any location • Encephalitis 	<ul style="list-style-type: none"> • Small intracranial mass, likely benign, no mass effect • Hemodynamically significant arterial stenosis (carotid or vertebral), not associated with acute symptoms or otherwise immediately threatening • Suspected brain metastases, established cancer diagnosis
GI	<ul style="list-style-type: none"> • Unexplained pneumoperitoneum • Closed loop intestinal obstruction • Intestinal ischemia and/or portal/mesenteric venous gas • Pseudoaneurysm or active hemorrhage (post-trauma, GI bleed, other) • High grade intra-abdominal organ injury (liver, spleen, pancreas, other) and/or bowel injury post-trauma, acute intervention likely 	<ul style="list-style-type: none"> • Abscess, any location • Intestinal obstruction, no evidence of acute ischemia • Intra-abdominal infection, likely surgical or interventional candidate (appendicitis, cholecystitis, diverticulitis, abscess, other) • Large volume ascites • Low to moderate grade intra-abdominal organ injury and/or bladder or bowel injury post-trauma, observation likely • Pneumatosis in bowel wall, no other signs of ischemia 	<ul style="list-style-type: none"> • Low volume ascites (any cause), portal hypertension, and/or cirrhosis

(continued)

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GU/OB	<ul style="list-style-type: none"> • Testicular torsion • Ovarian torsion • Ectopic pregnancy (high likelihood) • Placental abruption • Uterine rupture • High grade kidney injury and/or ureteral or bladder injury post-trauma, acute intervention likely • Absent perfusion post-op kidney 	<ul style="list-style-type: none"> • Oligohydramnios (less than fifth percentile for age) • Placenta previa or suspected placenta accreta, increta, percreta in third trimester • Embryonic/fetal demise • Incompetent cervix in pregnancy • Abnormal umbilical cord Doppler or IUGR • Urinary tract obstruction (stone, tumor, other) • Pyonephrosis/renal abscess • Abnormal appearing pregnancy for which short interval follow-up is recommended • Indeterminate findings for ectopic vs normal pregnancy 	<ul style="list-style-type: none"> • Placenta previa or possible previa in second trimester • Suspected placenta accreta, increta, percreta in second trimester • Abnormal findings on routine obstetrical ultrasound (possible fetal abnormality, abnormal growth, abnormal fluid volume, other), not likely to need acute intervention
Breast		<ul style="list-style-type: none"> • Biopsy recommended 	<ul style="list-style-type: none"> • Follow-up imaging recommended
MSK	<ul style="list-style-type: none"> • Nonspinal fracture and/or dislocation with risk of vascular compromise • Necrotizing fasciitis 	<ul style="list-style-type: none"> • Bone lesion at risk for pathologic fracture (femur, other) • Nonspinal fracture and/or dislocation without vascular compromise, likely to need intervention • Large hematoma without or with fracture, especially with compression of adjacent structures • Fracture follow-up imaging, significant change in alignment or concern of infection • Infection (including septic arthritis and osteomyelitis) • SCFE • Hardware complication 	<ul style="list-style-type: none"> • Nondisplaced minor fracture or questioned fracture, low risk for worsening • Routine fracture follow-up imaging, healing not progressing as expected or minor change in alignment
Chest	<ul style="list-style-type: none"> • Tension pneumothorax • Pulmonary embolus (CT or high probability V/Q scan), hemodynamically unstable, central embolus, and/or extensive emboli • Lung lesion with high possibility of being active TB • Superior vena cava occlusion (including SVC syndrome) • Large pericardial effusion and/or suspected tamponade of any cause • Active post-traumatic hemorrhage • Tracheal obstruction or impending obstruction 	<ul style="list-style-type: none"> • Pneumothorax, no evidence of tension • Lobar or lung collapse • Pneumomediastinum, interstitial emphysema, extensive subcutaneous emphysema • Pulmonary embolus, hemodynamically stable, limited extent peripheral emboli • Moderate or large pleural effusion • Significant superior vena cava compression or narrowing • Pneumonia 	<ul style="list-style-type: none"> • Lung nodule or suspected lung nodule, not clearly benign • Moderate pleural effusion • Moderate pericardial effusion
Cardiac/vascular	<ul style="list-style-type: none"> • Ruptured/leaking arterial aneurysm (thoracic or abdominal aortic or other) • Limb-threatening arterial or venous occlusion or high-grade stenosis • Arterial dissection or intramural hematoma (aortic, other) • Acute myocardial infarction 	<ul style="list-style-type: none"> • Hemodynamically significant arterial stenosis or occlusion, associated with acute symptoms • Occluded coronary or other bypass graft with associated symptoms • Deep venous thrombosis • Arterial pseudoaneurysm post-vascular access • Thoracic aortic aneurysm >6 cm or Abdominal aortic aneurysm >5 cm, no evidence of acute instability • Previously unknown chronic arterial dissection or intramural hematoma • Acute ischemia on cardiac imaging 	<ul style="list-style-type: none"> • Hemodynamically significant arterial stenosis or asymptomatic occlusion (extremity, other), not associated with acute symptoms or otherwise immediately threatening • Thoracic aortic aneurysm <6 cm, Abdominal aortic aneurysm <5 cm, other new peripheral aneurysm likely to require follow-up
Note: ET = endotracheal; GI = gastrointestinal; GU = genitourinary; IUGR = intrauterine growth retardation; IVC = inferior vena cava; MSK = musculoskeletal; OB = obstetric; SCFE = slipped capital femoral epiphysis; SVC = superior vena cava; TB = tuberculosis; V/Q = ventilation/perfusion.			