

STRUCTURED REPORTING OF FOCAL MASSES IN THE ABDOMEN: WITH A FOCUS ON CONSISTENT COMMUNICATION & MONITORING OF FOLLOW-UP RECOMMENDATIONS

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DISCLOSURES

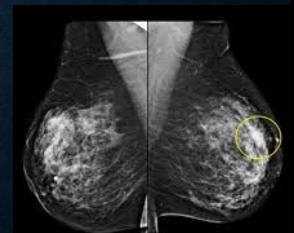
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PROBLEM

- Failure to complete follow-up
 - Associated with preventable patient harm as result of missed or delayed cancer diagnoses
 - Costs to health system
 - Patient safety and quality of care

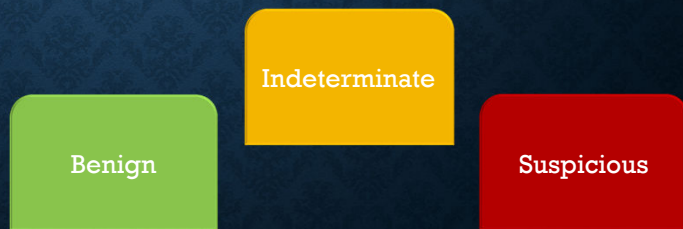
BACKGROUND

- Poor communication
 - Free text reports: variable & inconsistent
 - Identification & monitoring of patients?
- Structured Reporting
 - None outside of mammography
- Breast Imaging–Reporting and Data System (BI-RADS®)
 - Monitor, follow-up, and pathology outcomes



STRUCTURED REPORTING: ABDOMEN

- Implemented standardized language/categories for reporting likelihood of cancer in focal lesions (modeling after BI-RADS®)
 - Since July 1, 2013 – Hospital of the University of Pennsylvania
 - Focus on 4 organs:
 - Liver
 - Pancreas
 - Kidneys
 - Adrenal glands

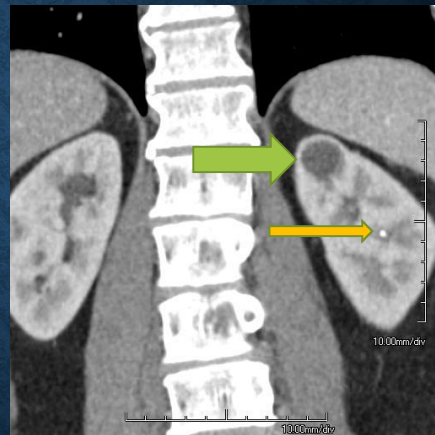


CODE ABDOMEN: CATEGORIES

- MAC 0: Incompletely evaluated. *If indicated within the patient's clinical context, follow up [INSERT MODALITY] is advised.* → **INDETERMINATE**
- MAC 1: No mass.
- MAC 2: Benign. *No further evaluation needed.** } **BENIGN**
- MAC 3: Indeterminate. *If indicated within the patient's clinical context, follow up [INSERT MODALITY] is advised within [INSERT TIME FRAME] [weeks/months].* → **INDETERMINATE**
- MAC 4: Suspicious. May represent malignancy.
- MAC 5: Highly suspicious. Clear imaging evidence of malignancy. } **SUSPICIOUS**
- MAC 6: Known cancer. → **KNOWN CANCER**
- MAC 7: Completely treated cancer. → **BENIGN (SURVEILLANCE)**
- MAC 99: Technically inadequate for evaluation of masses. → **TECHNICAL LIMITATIONS**

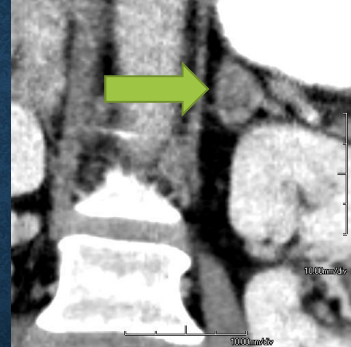
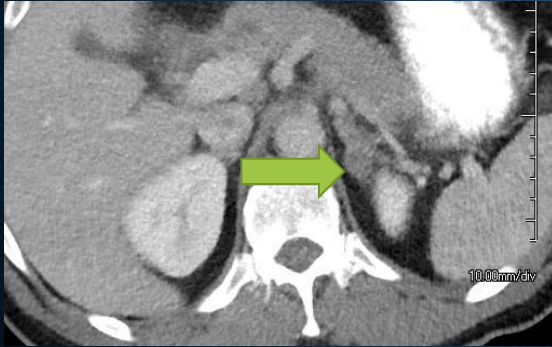
SELECT EXAMPLE CASES

CT: CATEGORY 2 - BENIGN



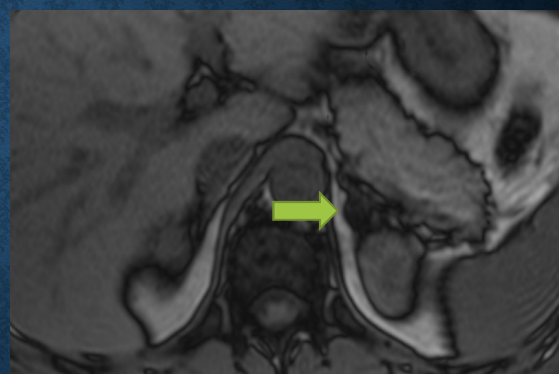
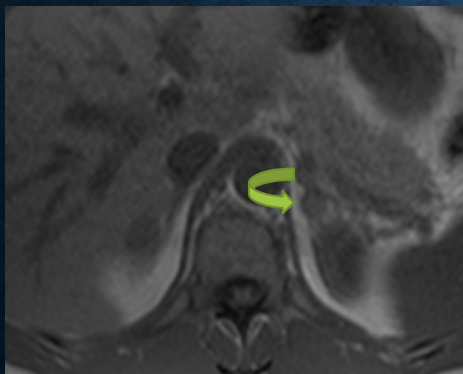
63 year old male with history of diabetes mellitus presents to the emergency room for abdominal pain. Index CT examination demonstrates single 2 cm fluid attenuation lesion (solid green arrow) within the upper pole of the left kidney as demonstrated on axial (left image) and coronal (right image) enhanced CT images representing benign renal cyst. Incidentally noted is a non-obstructing 2 mm calculus within the mid-pole of left kidney (solid yellow arrow).

CT: CATEGORY 0 – INDETERMINATE



54 year old male with remote history of Whipple procedure for cystic pancreatic neoplasm presents with abdominal pain. Axial (left image) and coronal (right image) enhanced CT images at the level of the adrenals revealed a heterogeneously enhancing 2 cm mass within the left adrenal gland (solid green arrow) measuring greater than 10 Hounsfield units. This was assigned a Category 0 and further characterization with MRI was recommended.

F/U MRI: CATEGORY 2 - BENIGN



54 year old male with remote history of Whipple procedure for cystic pancreatic neoplasm. Subsequent MRI exam, reveals that this mass contains microscopic lipid manifest as drop out of signal between the in phase (left image, curved arrow) and out of phase (right image, arrow) gradient echo images. This lesion was diagnosed as a benign adrenal adenoma and assigned a Category 2 on the MRI report.)

US: CATEGORY 3 – INDETERMINATE, INTERVAL TIME NECESSARY



May 2014 US Exam



March 2012 US Exam

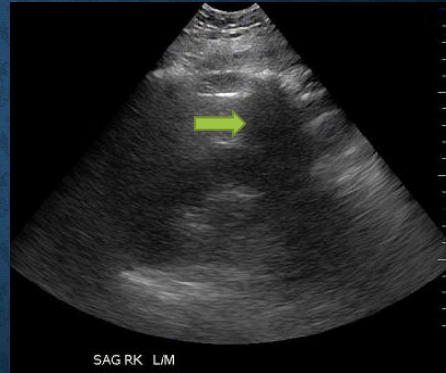
(68 year old female presents for follow-up of known right renal cyst. Ultrasound exam from May 2014 (left image), reveals an indeterminate complex cystic lesion with an avascular thickened septation that demonstrates soft tissue echogenicity but no vascular flow. This is similar in size and appearance to an exam from March 2012 (right image). In light of the interval stability conservative management with a subsequent ultrasound exam in one year was recommended.)

CT: CATEGORY 99 – TECHNICALLY INADEQUATE



54 year old male with history of cirrhosis presents with abdominal pain. Axial (left image) & coronal (right image) unenhanced CT images at level of liver demonstrates nodularity of the liver contour, mild hypertrophy of the caudate and left hepatic lobes and ascites; all consistent with known cirrhosis. In the absence of a triple phase protocol, evaluation of hepatic masses, specifically hepatocellular carcinoma, is not possible and this patient was assigned a Category 99.

US: CATEGORY 99 – TECHNICALLY INADEQUATE

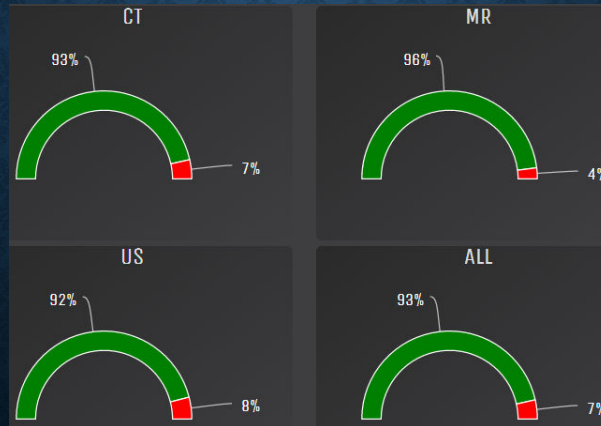


34 year old male with neurogenic bladder presents with recurrent urinary tract infections. An ultrasound examination of the retroperitoneum was performed to evaluate for hydronephrosis. Although the examination is adequate to answer the clinical question, it is technically inadequate to evaluate for masses due to poor acoustic penetration and shadowing from the ribs (solid green arrows) secondary to inability of the patient to hold deep inspiration.) Accordingly this patient was assigned a Category 99.

DATA/RESULTS

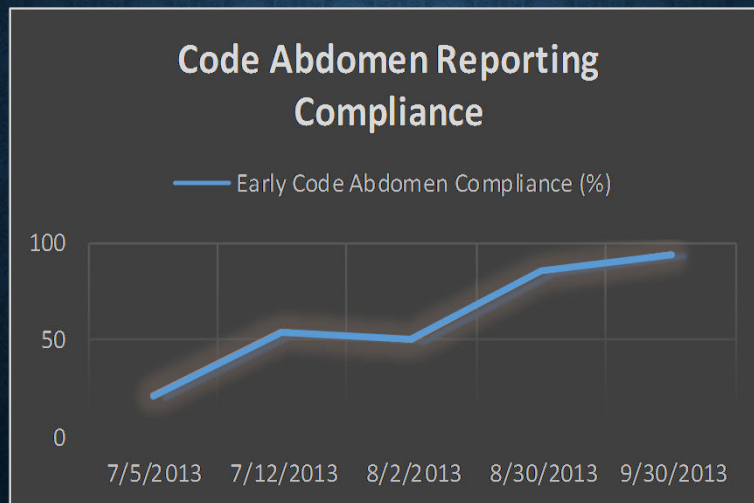
COMPLIANCE

- Over 24,585 US, CT, MRI eligible exams captured in our database
 - 93% compliance over 1st academic year of implementation



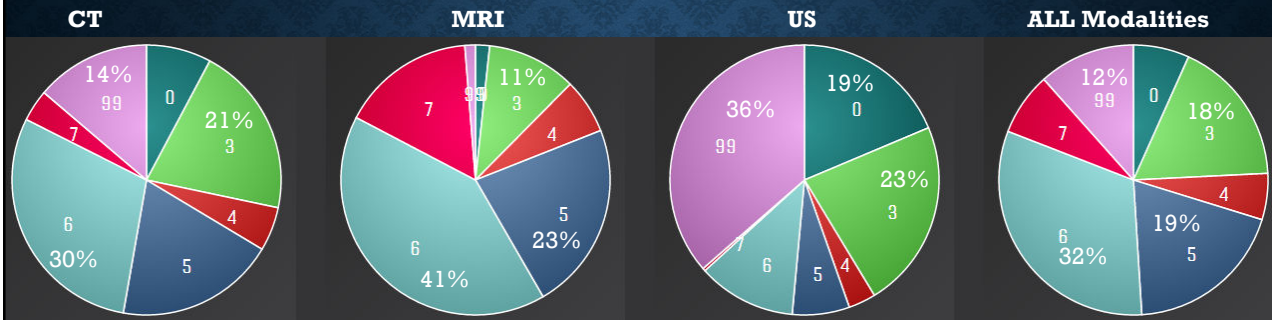
Graphical representation of compliance among the 3 (CT, MRI, US) modalities & cumulative (ALL)

EARLY COMPLIANCE



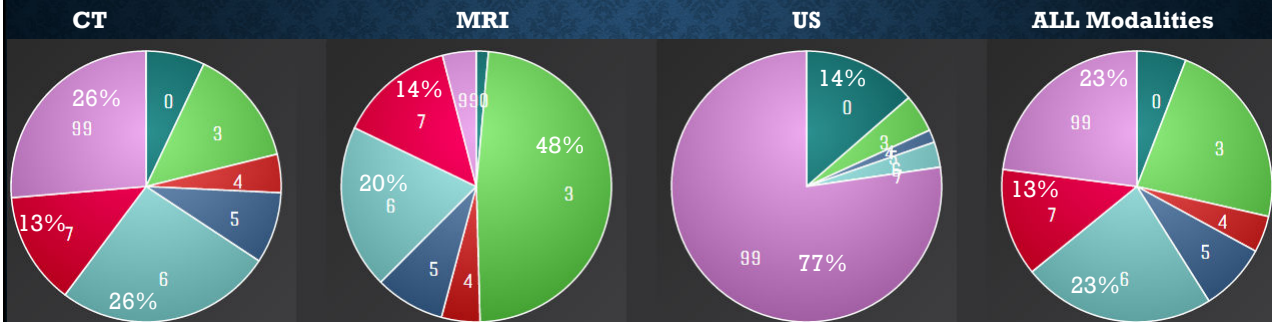
Expected low compliance initially. Dedicated educational orientation sessions for both radiology trainees & faculty during first phase (~4 week "warm-up phase"), helped gradually improve compliance.

CATEGORIES - LIVER



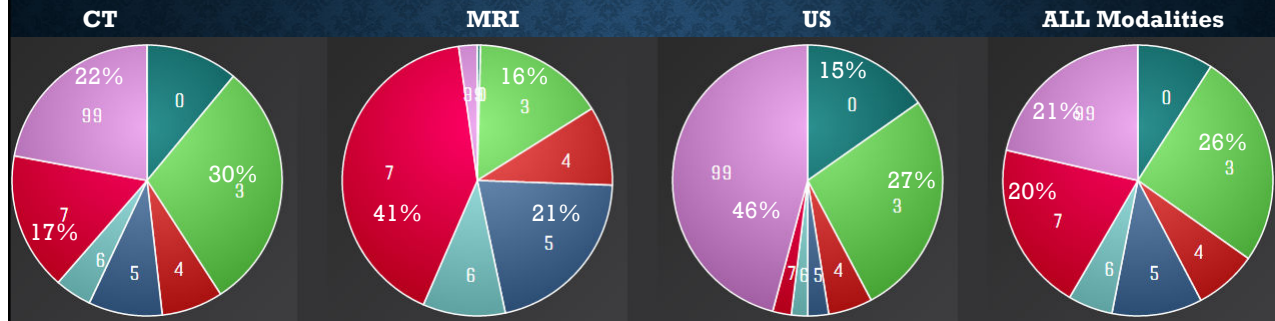
Distribution of Code Abdomen Categories within the Liver among the 3 (CT, MRI, US) modalities & collectively.

CATEGORIES - PANCREAS



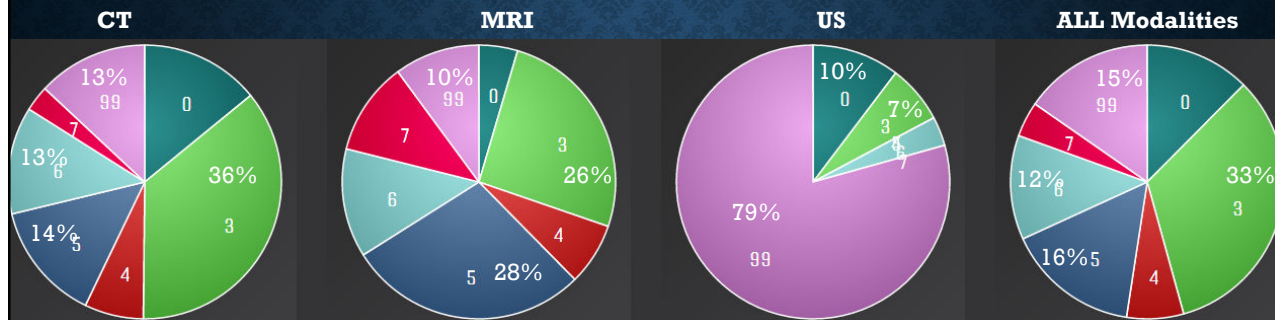
Distribution of Code Abdomen Categories within the Pancreas among the 3 (CT, MRI, US) modalities & collectively.

CATEGORIES - KIDNEYS



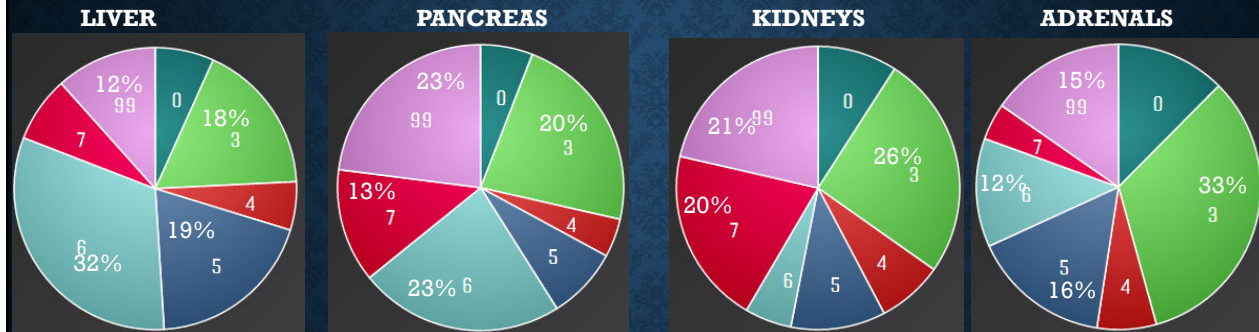
Distribution of Code Abdomen Categories within the Kidneys among the 3 (CT, MRI, US) modalities & collectively.

CATEGORIES - ADRENALS



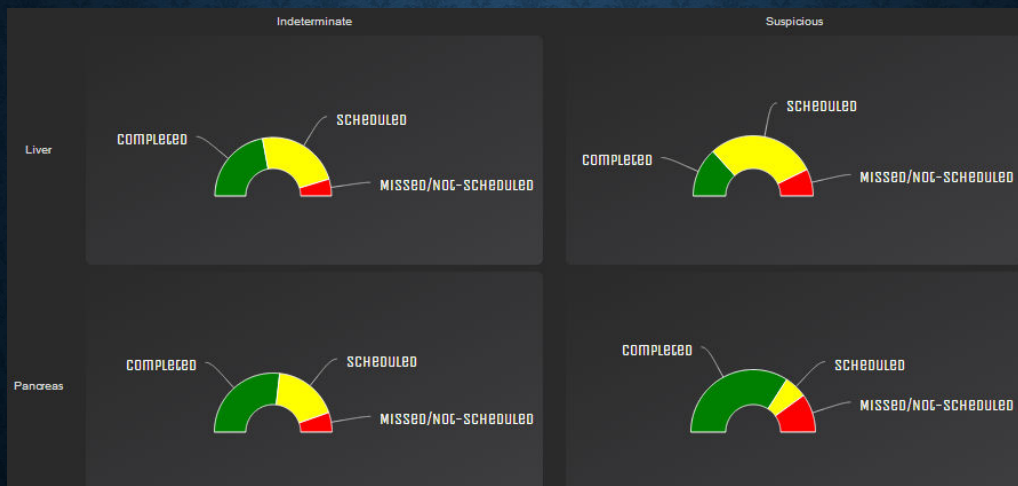
Distribution of Code Abdomen Categories within the Adrenals among the 3 (CT, MRI, US) modalities & collectively.

4 ORGANS – ALL MODALITIES



- Distribution of Code Abdomen Categories for the 4 organs (liver, pancreas, kidneys, adrenals) among all 3 modalities (CT, MRI, US) collectively.
- Ability to monitor our patients (follow-ups) prospectively (1st year of implementation):
 - 2,238 patients with indeterminate lesions (0 & 3's)
 - 1,302 patients with suspicious lesions (4 & 5's)

FOLLOW-UP STATUS SUMMARY



- Added benefit of structured reporting is the ability to mine reports for meaningful data.
- Follow-up status summary allows us to actively track the status of follow-up recommendations: completed, scheduled, missed/not-scheduled?

INDIVIDUAL PATIENT MONITORING

Accession Num	Patient ID	Exam Code	Exam Status	Modality	completed DTTM	Liver	Pancreas	Kidneys	Adrenals	Pathology Reports
15		CTAPE	F	CT	May 3 2014 9:24PM	2	1	1	3	pathology reports
15		CTAPE	F	CT	May 3 2014 2:41AM	1	1	3	1	none
15		CTAPE	F	CT	May 2 2014 12:00AM	3	1	1	1	none
15		CTAPU	F	CT	Apr 30 2014 6:26PM	99	99	3	1	none
15		MABI	F	MR	Apr 29 2014 9:22PM	1	1	1	1	
15		CTAPE	F	CT	Apr 28 2014 10:44PM	3	1	1	1	none
15		CTAPE	F	CT	Apr 27 2014 4:00PM	1	3	1	1	none
15		CTAPE	F	CT	May 3 2014 4:59PM	1	1	3	1	none
15		CTAPE	F	CT	Apr 27 2014 12:31AM	1	1	3	1	none
15		USLL	F	US	Apr 29 2014 4:32PM					
15		CTAPE	F	CT	Apr 27 2014 1:07AM	5	3	2	1	none

- Follow-up status allows us to track and determine outcomes at a patient level.

OUTCOMES OF RADIOLOGY FOLLOW-UP RECOMMENDATIONS IN ABDOMINAL IMAGING STUDIES

- 1,337 out of 8,801 patients (15%) with lesions indeterminate for cancer between 8/11/13 & 12/31/13.
- Of these, 424 patients (32%) underwent follow-up abdominal imaging within our hospital system over a 4 month span
 - Included 787 CT & 260 MRI exams cumulatively.
- On subsequent imaging, lesions were:
 - Downgraded to benign on 76% of patients (316/424)
 - Upgraded to suspicious for cancer in 6% (31/424)
 - Remained indeterminate in 18% (77/424).

CONCLUSION

- Code Abdomen - successful implementation of a standardized language for reporting focal masses.
- Improving communication with referring physicians & other radiologists.
- Facilitate identification of patients in whom follow-up is required.
- Expect evolution with input from radiologists, referring providers & eventually even patients.
- Expect significant long-term improvement in outcomes of our patients.

Code-Abdomen Assessment	Description	Classification
0	Incompletely evaluated. <i>If indicated within the patient's clinical context, follow up [INSERT MODALITY] is advised.</i>	Indeterminate
1	No mass.	Benign
2	Benign. <i>No further evaluation needed.</i>	Benign
3	Indeterminate. Future imaging follow up may be needed. <i>If indicated within the patient's clinical context, follow up [INSERT MODALITY] is advised within [INSERT TIME FRAME] [weeks / months].</i>	Indeterminate
4	Suspicious. May represent malignancy.	Suspicious
5	Highly suspicious. Clear imaging evidence of malignancy.	Suspicious
6	Known cancer.	Malignant
7	Completely treated cancer.	Benign (surveillance)
99	Technically inadequate for evaluation of masses.	Limited in evaluation due to technical factors

SUPPORT

- Abdominal Imaging Division – Penn Radiology
- Radiology Trainees – Penn Radiology

- T32 NIH-NIBIB Training grant
- Penn Medicine Center for Health Care Innovation