Structured Reporting: Establishing Department-Wide Consistency in Radiology Reports

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Background

- A high degree of variability exists in radiology reports
- Variability is present in nearly every aspect of the report including:
  - Layout
  - Formatting
  - Language used

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Potential Advantages of Structured Reports

- Improve report clarity and consistency
- Improve workflow and ease of dictation
- Serve as a checklist
- Decrease grammatical and transcription errors
- Development of commonly-agreed upon reports encourages consensus-building
- Consistent format

Potential Disadvantages of Structured Reports

- Radiologists may be less inclined to describe complex or variant pathology in favor of simplified structured responses
- Perceived loss of autonomy in reporting results
- Chance of retained structured elements that conflict with other parts of the report

Purpose:

- To successfully develop a department-wide structured reporting system and achieve widespread adoption

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Specific Aims

- Create structured reports for exams corresponding to >90% of departmental volume
- All reports will be endorsed by the division leaders prior to implementation
- The standard report format will be used in >90% of radiology reports
- The "normal" structured report will be used in >90% of cases in which the radiologist believes the study is normal

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Methods: Report Creation Process

- A structured report workgroup was formed, consisting of:
  - Department leaders
  - Division representatives
  - Quality and informatics leaders
  - Administrative personnel
- The structured report workgroup set the ground rules for creating reports:
  - Report format
  - Layout of the report
  - Agreed upon terminology
  - Technical details required for each report

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Standard Report Format

- A department-wide structured report format was established
- All reports contain 5 elements
  - Clinical History
  - Comparison
  - Procedure Comments
  - Findings
  - Impression

CLINICAL HISTORY: *Clinical History is prepopulated from the order.*

COMPARISON: [*Selections: None/Prior study from*]

PROCEDURE COMMENTS: *Modality specific procedure comments.*
CT: CT of the [*body part*] was performed [*Selections*: with/without/without and with] intravenous contrast.
RAD: [*Selections*: Single view/Two views/Three views] of the [*body part*].

FINDINGS:
[*Findings*]

IMPRESSION:
[*Impression*]

In this figure and subsequent figures the blue text represents either an explanation of the report content or the choices available to the radiologists.
Specific choices identified by the phrase Selections.

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Report Creation Process

- Division representatives were responsible for creating structured reports pertaining to their section
- Prior year volumes were used to assist in determining priorities
- For complex reports, initial drafts were created by review of previous reports

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Volumes were provided for each exam type

Procedure Description (Supplies & NM doses not included)	Quantity used in Fiscal 2008 (July 05 thru June 06)	ALL %	Modality %	Cumulative %
HB CHEST 1 VIEW	31886	14.1%	23.1%	14.1%
HB CHEST - 2 VIEWS	14812	6.6%	15.4%	20.8%
HB ABDOMEN 2 POSITION	9334	4.1%	6.8%	24.9%
HB ABDOMEN 1 POSITION	5905	2.6%	4.3%	27.5%
HB CT HEAD W/O CONTRAST	4663	2.1%	33.1%	29.6%
HB ULT RETROPERITONEAL (RENAL/GI)	4678	2.1%	34.2%	31.7%
HB RADIUS/ULNA 2 VIEW (FOREARM)	3108	1.4%	3.3%	33.1%
HB MRI BRAIN W/O CONTRAST	3021	1.3%	20.8%	34.4%
HB ULT SINGLE QUADRANT	3020	1.3%	15.7%	35.8%
HB WRIST - 2 VIEWS	2939	1.3%	3.2%	37.1%
HB INT VASC DR UP TO 1 HR	2778	1.2%	27.8%	38.3%
HB FLUORO SCOPY - UP TO 1 HOUR	2772	1.2%	3.0%	39.5%
HB SCOLIOSIS LIMITED (THORA LUMB)	2458	1.1%	2.6%	40.6%
HB ELBOW - 2 VIEWS	2372	1.0%	2.4%	41.6%
HB ANKLE 3+ VIEWS	2372	1.0%	2.4%	42.7%
HB CT ABDOMEN W CONTRAST	2100	1.4%	14.0%	43.6%
HB CT PELVIS W CONTRAST	2074	1.3%	13.8%	44.5%
HB FOOT 3+ VIEWS	2071	1.3%	2.2%	45.4%
HB TIBIA/FIBULA 2 VIEW	1965	1.3%	2.1%	46.1%
HB HAND 3 VIEWS	1929	1.3%	2.1%	46.9%
HB FLURO GUIDE VASCULAR ACCESS	1791	1.3%	17.4%	47.5%
HB ULT GUIDE VASCULAR ACCESS	1701	1.1%	16.5%	48.6%
HB MRI BRAIN W/WO CONTRAST	1693	1.1%	15.0%	49.7%

Structured Reporting:
Establishing Department-wide Consistency

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Guidelines for Report Creation

- Refer to the most common / most important clinical questions for each specific exam, including pertinent negatives
- Be concise
- Require no or minimal data entry for completing a normal dictation

Guidelines for Report Creation

- Text should not need to be removed when dictating a normal study
- Be able to be changed when reporting abnormal examinations, while preserving the overall format
- Include pick-list choices for the most common abnormal diagnoses

Structured Reporting:
Establishing Department-wide Consistency

Methods: Report Creation Process

- A checklist was developed to guide in creating new reports

Guidelines/Checklist for the Structured Report Template

Format:

- ☐ Template should follow standard format/headers (CLINICAL HISTORY, COMPARISON, PROCEDURE COMMENTS, FINDINGS, and IMPRESSION)
- ☐ Should be divided into logical sections.
  - If narrative format, paragraphs should be succinct, few (<= ~4 in the findings section), and logically grouped according to anatomy.
  - If ordered list format, should have logical order and items should be limited to those important to clinicians.
- ☐ Minimizes number of tab stops and fill-in fields. No. of tab stops:_____
- ☐ Draws attention to abnormalities in findings and impression.

Language:

- ☐ All phrases are commonly understood by radiologists and clinicians.
- ☐ Minimizes language that radiologists will frequently remove from a normal report.
- ☐ No impressions in the findings section.
- ☐ Avoids noncontributory language in template (e.g. is seen, no definite, grossly…).
- ☐ No grammar, punctuation, or spelling errors.

Report elements:

- ☐ Describes normal findings desired by the clinicians in a normal report.
  - Findings include pertinent negatives referring to the most common/important clinical questions.
- ☐ Includes fill-in fields for most common abnormal diagnoses.
  - Not for less relevant findings or less common diagnoses.
- ☐ Normal exam should require no or minimal data entry.
- ☐ The radiologist should not have to remove any text for a normal report.
- ☐ Easy to choose single areas of concern and replace with abnormal findings.
  - Prevents accidentally leaving in normal findings when the study is abnormal
- ☐ For more specialized exams, also functions as a checklist. (Logical order)
  - More general exam templates should be more succinct, less thorough.
- ☐ Includes elements necessary for reimbursement.

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Developing the Chest Report

3 examples from **2009**

CLINICAL HISTORY: MVA.

COMPARISON: None.

FINDINGS: Lungs are clear. The cardiomediastinal silhouette is unremarkable. No fractures.

IMPRESSION: No acute cardiopulmonary process.

CLINICAL HISTORY: PNEUMONIA.

COMPARISON: April 14, 2009.

FINDINGS/IMPRESSION: The right-sided central line terminates over the cavoatrial junction. The cardiomediastinal silhouette is stable in size. There is no pneumonia, effusion, or pneumothorax present.

CLINICAL HISTORY: COUGH.

COMPARISON: No prior.

FINDINGS: The cardiomediastinal select is normal in size. The lungs are normal in volume. There is no pneumonia, effusion, or pneumothorax.

IMPRESSION: The exam is negative for pneumonia.

2011 Normal Chest

CLINICAL HISTORY: cough and fever.

COMPARISON: Prior study from 04/01/2002

PROCEDURE COMMENTS: Two views of the chest.

FINDINGS:
The lungs are clear. There is no pneumothorax or pleural effusion.

The cardiothymic silhouette and mediastinal contours are normal.

The bones and upper abdomen are normal.

IMPRESSION:
Normal radiographic examination of the chest.

2009 & 2011 Chest reports

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Developing the CT Abd/Pelvis Report

2009 Report CT Abd Pelvis

CLINICAL HISTORY: 14-year-old male status post motor vehicle crash, with multiple extremity fractures and a facial fracture. Patient was an unrestrained passenger in the back seat.

COMPARISON: None.

PROCEDURE COMMENTS: Helical images were acquired from the dome of the diaphragms through the pubic symphysis following the uncomplicated IV administration of 120 mL of Optiray 320. The contrast was power-injected through a 20-gauge IV in the left forearm at 2 mL/sec. 8 oz. of water was given orally prior to scanning. Coronal reformatted images were created after imaging was obtained. Sagittal reformats in bone algorithm to evaluate the spine.

FINDINGS:

ABDOMEN: The lung bases are clear without pleural fluid or pneumothorax. The upper abdominal solid viscera including the liver, spleen, pancreas, kidneys, and adrenal glands are normal. The bowel loops and mesentery are unremarkable. No free peritoneal air or fluid is seen. The osseous structures are normal.

PELVIS: The pelvic bowel loops, mesentery, and partially opacified bladder are normal. No free peritoneal air or significant peritoneal fluid is present. No osseous injuries of the pelvis are seen.

A normal appendix is visualized.

IMPRESSION: Normal CT of the abdomen and pelvis.

2011 Report CT Abd Pelvis

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Methods: Report Editing

- All new structured report templates were edited by a small subcommittee to ensure that reports:
  - Used consistent language across the department
  - Minimized noncontributory language (e.g. "is seen," "no definite," "grossly," etc.)
  - Were free of grammatical, punctuation, and spelling errors
  - Included all elements required for reimbursement
  - Were efficient and easy to use

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Methods: Report Vetting

- After the report was reviewed by the subcommittee the changes were reviewed by the division representative
  - Disagreements were resolved in a consensus session
- Once approved by the division representative, the report was emailed to affected radiologists for comment
  - Comments were reviewed and addressed on a case-by-case basis

Report Deployment

- Approved structured reports were entered into the speech recognition system
- Each was linked to a specific Radiology Information System (RIS) exam code
- RIS exam code linking enabled the system to automatically launch an exam-specific report when the study is opened

Exam-Specific Reports

- Exam-specific reports were created for some studies performed for specific indications
  - Examples:
    - Ultrasound for appendicitis
    - MRI Enterography
    - CT of the Chest, Abdomen, and Pelvis
  - Specific exams linked to appropriate CPT code

Standard report: Ultrasound Appendicitis

CLINICAL HISTORY: *Clinical History is prepopulated from the order.*

COMPARISON: [*Selections: None/Prior study from*]

PROCEDURE COMMENTS: Graded compression ultrasound was performed in the potential locations of the appendix.

FINDINGS:
The appendix [*Selections:* is/is not] visualized.

RIGHT LOWER QUADRANT TRANSDUCER TENDERNESS:
[*Selections:* No/Mild/Moderate/Marked] tenderness with compression.
[*Selections:* No/Mild/Moderate/Marked] rebound tenderness.

APPENDICEAL DIAMETER (with compression): [*Diameter*]
PERIAPPENDICEAL FAT INFILTRATION: [*Selections:* N/A/Absent/Present].

APPENDICOLITH: [*Selections:* N/A/Absent/Present].
VASCULARITY OF THE APPENDIX: [*Selections:* N/A/Normal/Hypervascular].
PERI-APPENDICEAL FLUID: [*Selections:* N/A/None/Mild/Moderate/Marked].
COMPRESSIBILITY OF THE APPENDIX: [*Selections:* N/A/Compressible/Non-compressible].

OTHER COMMENTS: [*Other*]

IMPRESSION:
Selections: 5 available
Normal:
Normal appendix visualized. No findings to support a diagnosis of appendicitis.

Intermediate:
Appendix visualized. Findings suggest an intermediate likelihood of acute appendicitis.

Positive:
Appendix visualized. Findings consistent with acute appendicitis.

Not identified, no findings of appendicitis:
Appendix not visualized. However, there are no ultrasound findings to support a diagnosis of appendicitis.

Not identified, but secondary findings of appendicitis:
Appendix not visualized, but secondary findings are present that could be associated with acute appendicitis.

Additional Examples-Exam specific reports

Standard report for: MR Chest Pectus Excavatum

CLINICAL HISTORY: *Clinical History is merged from the order*. Evaluate severity of pectus excavatum.

COMPARISON: [*Selections:* None/Prior study from]

PROCEDURE COMMENTS: Limited MRI of the chest was performed.

FINDINGS:
Pectus excavatum is present. There is no marked sternal tilt. The chest wall appears grossly symmetrical (right compared to left). [*Selection:* The sternum compresses the free wall of the right ventricle.]

IMPRESSION:
Pectus excavatum with a maximum Haller index of [Haller index]

Standard Report for: CT Renal Donor

CLINICAL HISTORY: *Clinical History is merged from the order* Living donor renal transplant evaluation.

COMPARISON: [Comparison: None/Prior study from]

PROCEDURE COMMENTS: CT of the abdomen and pelvis was performed with intravenous contrast. A delayed scout tomogram was performed. Multiplanar, curved reformatted, and 3-dimensional reconstructions were performed.

FINDINGS:

LOWER THORAX: [Thorax]

RIGHT KIDNEY: The right kidney has a normal appearance and position. There are no masses, stones, or scars. [Right duplication] There is a [right fat: small/medium/large] amount of perirenal fat. There [Right renal artery: one/two/three] [Renal artery]. The renal vein has a normal course. There is no pelvocaliectasis or hydroureter. [Right ureter: One/Two] from the renal hilum. The ureter inserts normally into the bladder.

LEFT KIDNEY: The left kidney has a normal appearance and position. There are no masses, stones, or scars. [Left duplication] There is a [left fat: small/medium/large] amount of perirenal fat. There [Left renal artery: one/two/three] [Renal artery] The renal vein has a normal course. There is no pelvocaliectasis or hydroureter. [Left ureter: One/Two] from the renal hilum. The ureter inserts normally into the bladder.

URINARY BLADDER: [Bladder]

LIVER AND BILIARY SYSTEM: [Liver and biliary system]
SPLEEN: [Spleen]
PANCREAS: [Pancreas]
ADRENAL GLANDS: [Adrenal Glands]

BOWEL: [Bowel]
APPENDIX: [Appendix: Not seen/Normal]
PERITONEAL CAVITY: [Peritoneal cavity]

UTERUS AND OVARIES: [Uterus and ovaries]

OTHER VASCULATURE: [Vasculature]
LYMPH NODES: [Lymph nodes]

Gender-Specific Reports

- Reports can be gender specific
  - Gender information obtained from HL7 order information
  - Gender-specific report is automatically populated

Standard Report: Ultrasound Pelvis (Female)

CLINICAL HISTORY: *Clinical History is prepopulated from the order.*

COMPARISON: [*Selections: None/Prior study from*]

PROCEDURE COMMENTS: Ultrasound of the pelvis was performed.

FINDINGS:
Right ovary: [*Right measurement*] cm, volume of [*right volume*] mL.
Left ovary: [*Left measurement*] cm, volume of [*left volume*] mL.
Uterus: [*Uterus long axis*] cm long axis, [*uterus AP*] cm AP, [*uterus transverse*] cm transverse.
Endometrial stripe: [*Endometrial*] mm.

[*Both ovaries are visualized and are normal.*] There are follicle [*selections: fewer/more*] than 12 follicles in each ovary. [*All follicles measure less than 1 cm in diameter.*] The uterus is normal in morphology and echogenicity.

The urinary bladder is [*selections:* decompressed/incompletely distended/well distended] and appears normal. No abnormal masses or fluid collections are visualized.

IMPRESSION:
[*Normal pelvic ultrasound*]

Standard Report: Ultrasound Pelvis (Male)

CLINICAL HISTORY: *Clinical History is prepopulated from the order.*

COMPARISON: [*Selections: None/Prior study from*]

PROCEDURE COMMENTS: Ultrasound of the pelvis was performed.

FINDINGS:
No abnormal masses or fluid collections are visualized. The urinary bladder is [*Selections:* decompressed/incompletely distended/well distended] and appears normal.

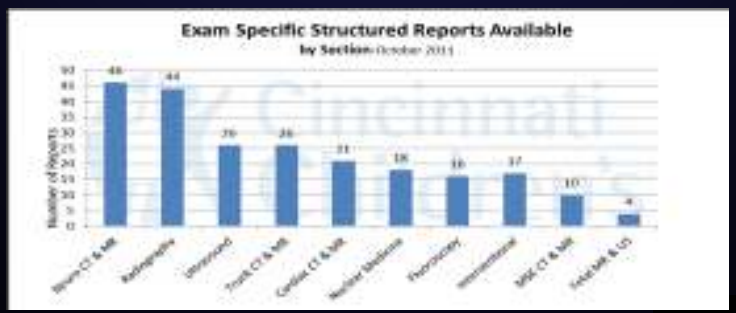
IMPRESSION:
[*Normal pelvic ultrasound*]

Methods: Report Auditing

- Periodic audits were completed to assess performance relative to the departmental goals

Results: Structured Reports

- By April 2010, the first individual structured reports were deployed throughout the department
- By July 2010, structured reports corresponding to 80% of examinations had been deployed
- By March 2011, 178 exam specific structured report templates had been implemented, corresponding to 90.1% of studies by volume
  - Radiologists used an exam specific standard report for dictation of normal exams 93% of the time
- As of October 2011, there are 228 structured report templates, corresponding to 94% of studies by volume
  - Reports are available for all sections in the department



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Results: Audits

Audit results show high adoption rate of the structured reports

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Conclusions

- Structured reporting can be implemented on a department-wide basis, achieving high acceptance by the radiologists
- Current voice recognition software enables exam-specific automation of reports, facilitating use of department-approved reports
- Achieving consensus is essential for successful adoption and deserves appropriate consideration

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Future Directions: Research and Quality Improvement

- Use of specific elements of the standard reports for research
- Able to do data mining/review based on consistent elements in reports

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Information Systems in use at Cincinnati Children's Hospital

- Dictation:
  RadWhere Nuance- Boston, MA
  www.Nuance.com
- Hospital Information System (HIS):
  EPIC- Verona, WI
  www.EPIC.com

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