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Implementation of CT Protocol Management Software to Detect Deviations From Master Protocols

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INTRODUCTION

- While CT protocol management is essential for obtaining consistently high-quality images at reasonable radiation doses, managing system protocols across different models and vendors can be time-consuming.¹
- Master protocols are reviewed and revised regularly by radiologists, technologists, and physicists, often fulfilling regulatory and accreditation requirements.
- With dozens of parameters in each CT protocol, it is difficult to make sure thousands of system parameters match the standardized master protocols across an enterprise.¹⁻³
- Previously, comparisons were made manually between each system protocol and our master protocol spreadsheet.

AIM

- This study implements software that aims to streamline the cumbersome task of standardizing and harmonizing scanner protocols.
- Having an automated tool to identify variations in protocol parameters between different scanners across a health care system may provide more consistent patient imaging and saves time and effort in the already busy imaging department.

METHOD

- Protocol management software was implemented to import system protocol backup files from the CT scanners at our main campus (8 scanners, 2 vendors, 7 models).
- For initial testing of the software, our master protocol spreadsheet for abdominal protocols was processed and imported by the software vendor (Qaelum NV).
- Imported system protocols were viewable via a web interface, which also allowed protocols for different models to be visually compared.
- Deviations between system parameters and master protocols for each system were flagged for review.

RESULTS

The tree that includes all the master protocol families was automatically created, with each family consisting of a generic description and the model-specific master protocols (Figure 1). The system protocols were compared against the standardized master protocols, and the deviations were automatically found. Figure 2 shows the number of deviations found for each unit. In 29 abdominal protocols across 8 scanners, 346 deviations from the master protocols were found. The type of deviations found are shown in Figure 3.

Protocol management

Protocol tree

- CT protocols
- Abdomen Protocols
 - CT ABDOMEN
 - CT ABDOMEN/PELVIS
 - CT ADRENAL MASS
 - CT COLONOGRAPHY
 - CT CYSTOGRAPHY - see CT Routine Pelvis for
 - CT Enterography - see CT Routine Abdomen
 - CT DUAL PHASE LIVER
 - CT TRIPLE PHASE LIVER (include through)
 - CT LIVER DONATION
 - CT NEUROENDOCRINE PANCREATIC MA
 - CT PANCREATIC CANCER STAGING (NOT
 - CT PELVIS
 - CT RENAL MASS
 - CT STONE STUDY
 - CT STONE LOW-DOSE FOLLOW-UP
 - CT Trauma Abdomen/Pelvis
 - CT UROGRAM
 - CT Body Interventional
 - CT Body Interventional All Workflow
 - Dual Energy CT Routine Abdomen/Pelvis
 - Dual Energy CT Routine Pelvis
 - Dual Energy CT Stone Study
 - Dual Energy CT Triple Phase Liver
 - CT Enterography
 - CT TRIPLE PHASE LIVER (include through
 - CT STONE LOW-DOSE FOLLOW-UP
 - CT Child Abdomen and/or Pelvis

CT ABDOMEN

Protocol description

Name: CT ABDOMEN Modality: CT Compliance protocol

Radiology code: RPIDS - CT ABDOMEN WITH IV CONTRAST Clinical indication: [dropdown]

Population: Adults Patient size: Unknown Age category: Adult Body region: ABDOMEN

Protocol details

Name	Key	Value type	Value
Indication	indication	TEXT	Abdominal pain, most other general indications
Oral Contrast	oral_contrast	TEXT	PO Omnipaque with 30, 45, or 60 minute prep time
IV Contrast	iv_contrast	TEXT	Weight based Iodine injection protocol
Delay	delay	TEXT	80 Second
Respiration	respiration	TEXT	Inspiration
FOV	fov	TEXT	Cone in to anatomy, not to exclude any muscle
Scan range	scan_range	TEXT	See ranges below
Special Instructions	special_instructions	TEXT	Adjust CAV slide bar to 3 if without contrast
Typical CTDI Range (mGy)	typical_ctdi_range_mgy	TEXT	8-31
Scanner Protocol Name	scanner_protocol_name	TEXT	ABDOMEN_WITHOUT or ABDOMEN_WITH

Figure 1: The tree with the master protocol families as shown in the protocol management software by Qaelum (left). The description of the standardized CT abdomen protocol is displayed (right) and can be reviewed and modified if necessary.

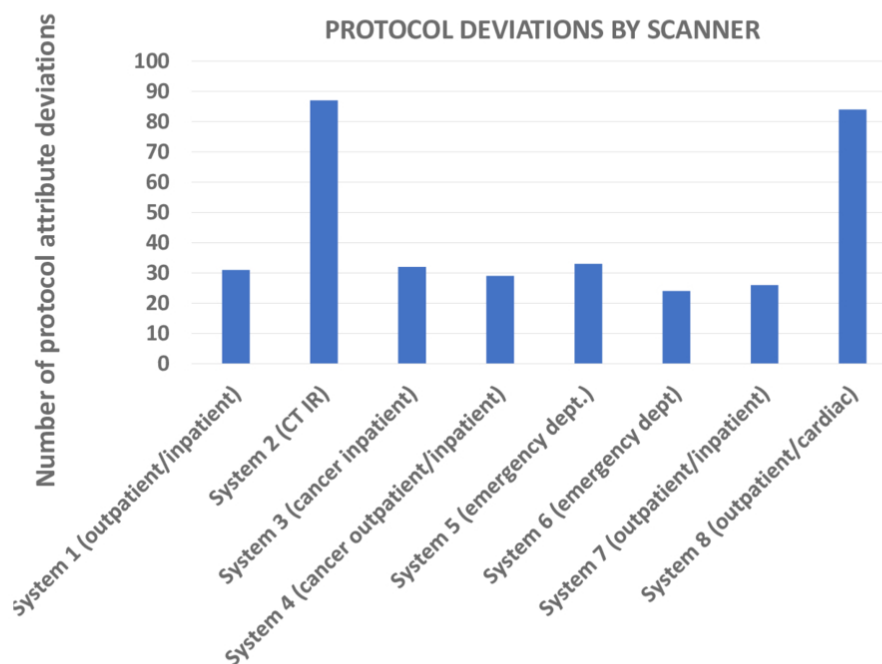


Figure 2: The number of deviations found by the protocol management software per system.

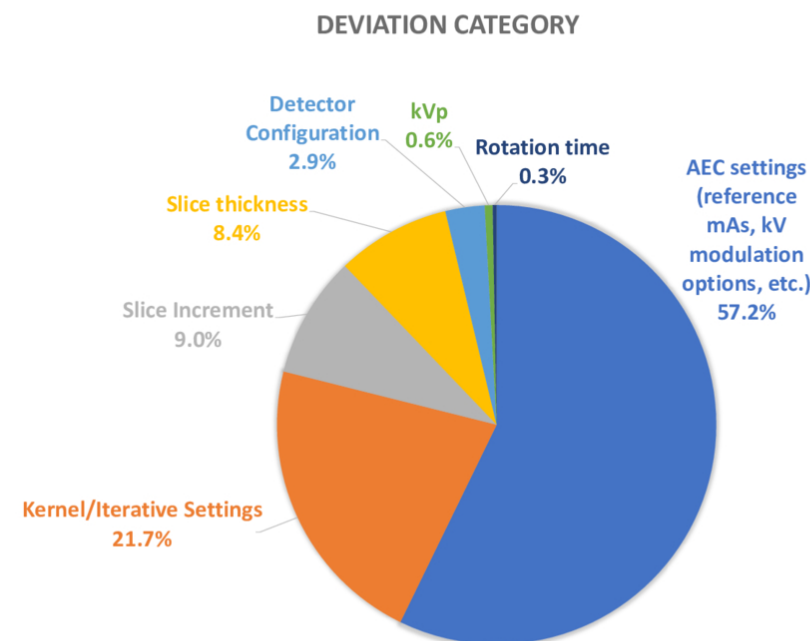


Figure 3: Categorization of the 346 deviations from the master protocols.

CONCLUSIONS

- We found a number of differences between system and master protocols in this initial implementation for abdominal protocols at our main campus.
- Differences occurred even though protocols were password-protected and lead technologists had previously worked many hours to match system protocols to master protocols.
- As we expand to other anatomy areas and include outlying sites, we expect identifying necessary changes to the myriad of protocol parameters on each system to be simplified using the dedicated protocol management software.

DISCLOSURES

Ohio State University has a research agreement with Qaelum NV, but no funding was provided for this work. N. Fitousi and J. Jacobs are employees of Qaelum NV.

REFERENCES

- K. Little, "Overview of CT Protocol Parameters and Protocol Management Pitfalls," presented at the 2019 Annual Meeting of the Radiological Society of North America, Chicago, IL, 8 Dec. 2019.
- J. Grimes, et. al., "Implementation and evaluation of a protocol management system for automated review of CT protocols," J Appl Clin Med Phys **17**, pp. 523-533 (2016).
- T. P. Szczykutowicz, et. al., "A Wiki-Based Solution to Managing Your Institution's Imaging Protocols," J Am Coll Radiol **13**, pp. 822-824 (2016).

CONTACT INFORMATION

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