Use of an "Auto-Protocol" Workflow to Decrease Provider and Technologist Protocoling Burden in Radiology

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Background

- Protocoling of CT exams = significant work by radiology providers and technologists

- Many exam codes must be tailored to clinical indication and require manual (human-assigned) protocol to ensure right study is performed

- Other codes follow a standard protocol every time
  - Manual protocoling consumes human resources without adding value

SMART Goal

- Create an auto-protocol workflow integrated into our Electronic Health Record (EHR; Epic Systems Corp., Verona, WI) to reduce the number of CT exams requiring manual protocol assignment by 25% within 90 days.

Methods

- Team: subspecialty radiologists, CT technologists, quality improvement specialists

- Consensus on CT studies for which manual protocol assignment provides little value

- Created auto-protocol workflow in EHR

- Tested on 4 pilot codes then expanded

- Measured time to protocol case by stopwatch via observation

- Analyzed percent protocol reduction and study order to begin (O-B) times for ED studies

CT Codes Selected

IMG Code	Name
IMG2734	CT 4D NECK W WO IV CONTRAST/PARATHYROID(BH YH WH)
IMG1427	CT ABDOMEN PELVIS ENTEROGRAPHY W IV CONTRAST (BH YH YHC LM WH)
IMG1379	CT ANKLE LEFT WO IV CONTRAST
IMG1668	CT ANKLE RIGHT WO IV CONTRAST
IMG1264	CT CARDIAC SCORING WO IV CONTRAST(GH YH BH YHC LM)
IMG2739	CT CERVICAL SPINE BONE WO IV CONTRAST (YH GH BH WH)
IMG207	CT CERVICAL SPINE WO IV CONTRAST
IMG2748	CT CHEST VASCULAR WO IV CONTRAST GATED (YH)
IMG2758	CT CYSTOGRAM(GH BH YH LM WH)
IMG3516	CT ELBOW LEFT WO IV CONTRAST
IMG2389	CT ELBOW RIGHT WO IV CONTRAST
IMG1242	CT FACIAL BONES WO IV CONTRAST
IMG1377	CT FOOT LEFT WO IV CONTRAST
IMG1378	CT FOOT RIGHT WO IV CONTRAST
IMG1739	CT HAND LEFT WO IV CONTRAST
IMG1740	CT HAND RIGHT WO IV CONTRAST
IMG2828	CT HEAD CERVICAL SPINE WO IV CONTRAST (BH YH YHC)
IMG4349	CT HEAD FACIAL BONES CERVICAL SPINE WO IV CONTRAST (BH YH YHC)

IMG Code	Name
IMG4343	CT HEAD FACIAL BONES WO IV CONTRAST (BH YH YHC)
IMG4938	CT HEAD VENOGRAM WO AND/OR W CONTRAST
IMG181	CT HEAD WO IV CONTRAST
IMG3982	CT HEAD WO IV CONTRAST (STROKE)
IMG4292	CT HEAD WO IV CONTRAST W 3D RECONSTRUCTION (YH)
IMG1680	CT HEEL LEFT WO IV CONTRAST
IMG1683	CT HEEL RIGHT WO IV CONTRAST
IMG1371	CT HIP LEFT WO IV CONTRAST
IMG1372	CT HIP RIGHT WO IV CONTRAST
IMG4287	CT INITIAL LUNG CANCER SCREENING
IMG228	CT KNEE LEFT WO IV CONTRAST
IMG229	CT KNEE RIGHT WO IV CONTRAST
IMG2834	CT LUMBAR SPINE BONE WO IV CONTRAST(BHOR YH LM WH)
IMG213	CT LUMBAR SPINE WO IV CONTRAST
IMG1244	CT MANDIBLE WO IV CONTRAST
IMG2841	CT NEURO PERFUSION (BH YH GH)
IMG4547	CT RENAL STONE (HIGHLY LIKELY OR PRIOR STONE, LOW RADIATION)

IMG Code	Name
IMG2852	CT RENAL STONE WO IV CONTRAST NO ORAL(BH YH YHC)
IMG1723	CT SHOULDER LEFT WO IV CONTRAST
IMG1726	CT SHOULDER RIGHT WO IV CONTRAST
IMG4933	CT SINUS PRE-SURGICAL PLANNING WO IV CONTRAST
IMG1245	CT SINUS WO IV CONTRAST
IMG4288	CT SUBSEQUENT LUNG CANCER SCREENING
IMG184	CT TEMPORAL BONES / INTERNAL AUDITORY CANALS WO IV CONTRAST
IMG4327	CT THORACIC LUMBAR SPINE WO IV CONTRAST (BH YH)
IMG2860	CT THORACIC SPINE BONE WO IV CONTRAST(YH BH LM WH)
IMG210	CT THORACIC SPINE WO IV CONTRAST
IMG1233	CT VIRTUAL COLONOSCOPY DIAGNOSTIC (BH YH)
IMG1662	CT VIRTUAL COLONOSCOPY SCREENING(BH YH)
IMG1733	CT WRIST LEFT WO IV CONTRAST
IMG1734	CT WRIST RIGHT WO IV CONTRAST
IMG4786	CTA HEAD NECK STROKE CODE W IV CONTRAST
IMG4932	CTA HEAD PITUITARY W AND/OR WO SURGICAL PLANNING
IMG786	CTA HEAD W AND/OR WO IV CONTRAST
IMG200	CT CHEST WO IV CONTRAST

Workflow in EHR

- Selected codes removed from Radiologist/technologist protocol worklists

- New column created on CT technologist worklists with designated icon (orange arrow) mapped to auto-protocol codes

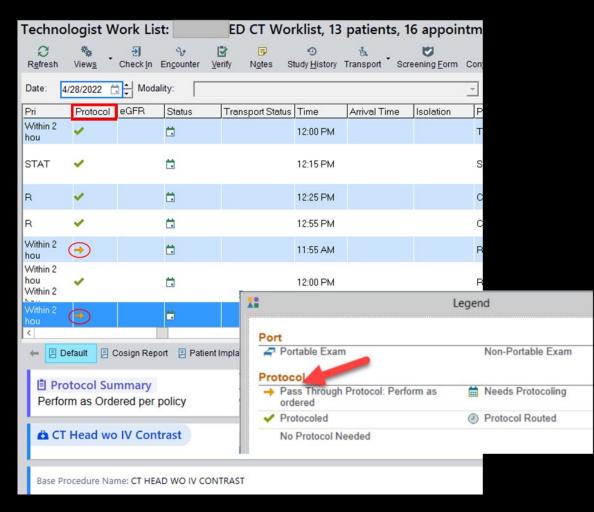- Language automatically inserted into protocol instructions stating, "Perform as ordered per policy"

Figure 1. New CT tech worklists.

Results

- 28% (53/192) of CT codes were selected as eligible for auto-protocol

- Baseline: 10,185/13,093 (78%) of all ordered CT scans were manually protocoled

- Post intervention: 5,548/10,259 (54%) of exams were manually protocoled
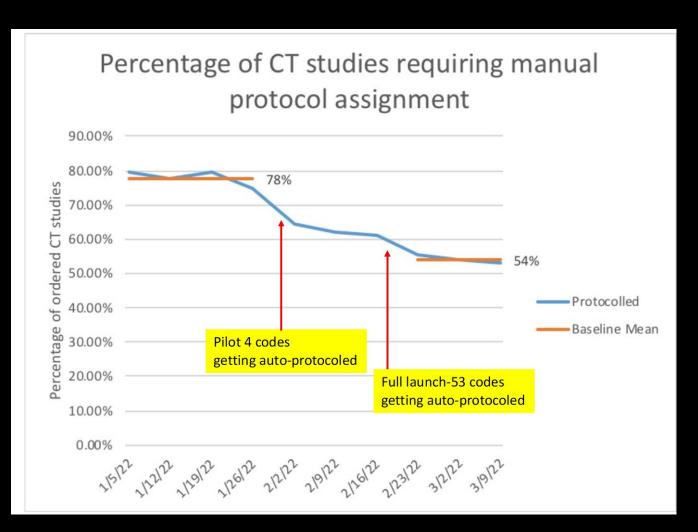 - 24% absolute and 30% relative reduction from baseline

Figure 2. Run chart of CT orders receiving manual assigned protocol pre and post auto-protocol project.

Results

8% relative improvement in order to begin time for ED CTs post intervention (*56 vs 61 mins*)

Based on measured mean time to protocol a CT of 15 seconds, estimate 170 work hours spent protocoling will be saved annually.

Discussion

- New workflow needed to decrease inefficiencies related to protocoling and ED CT order-to-begin times

    - Prior to project implementation, auto-protocol eligible codes were unnecessarily crowding protocol worklists for rads and techs

    - Even for codes which "off the record" did not require a protocol selection (ex: CT head without contrast), only 10% were scanned without a protocol assigned (many of these manually marked as "perform as ordered") resulting in wasted effort

Discussion

- Limitation: potential for incorrectly ordered exams (that are auto-protocol eligible) being scanned that may have been corrected during old protocol process
  - CT codes carefully selected for inclusion
  - Technologists encouraged to discuss any discrepancies between order and provided indication with appropriate radiology service before scanning

- Initiative now implemented throughout ALL Yale New Haven Health CT scan departments improving Radiologist and Technologist efficiency at 4 other hospitals

- Work underway to adapt similar auto-protocol workflow to MRI