Preliminary Investigation of Clinical CT Workflow Elements

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Introduction

Healthcare systems seek clinical CT scan workflow improvements for clinical, operational, and financial reasons. Despite many manufacturers marketing CT workflow efficiencies, studies quantifying these features is sparse. This work investigates the different elements of the CT imaging workflow.

Methods

CT imaging workflow was observed for a month to identify key session stages as determined in consultation with senior CT technologist staff.
Durations of each stage and tasks within were measured using Work study plus time software. Each stage was time stamped manually by the observer. The same observer was used for all exams.

- Total exams: 34 patient imaging sessions
- Time period: 4 weeks

CT systems observed:

- Canon One/insight
- Canon Precision
- GE VCT
- GE Revolution [mobile trailer]

Figure 1. Timer interface WorkStudy+ Ontario, Canada

Results

T-Test two tailed of unequal variance : There Is a significant difference in workflow times between ambulatory and non-ambulatory patients (0.0367≤ 0.05) and
Between console and patient interaction time (0.0004 ≤ 0.05).

Limitations

Causes for inconsistent scan times include:
Gated exams, Delays, Observer reaction time when manually timing, Workflow set-up for ED, Trailers less interrupted, Protocol type bias on different scanners can influence scan time performance, Small sample size

Conclusion

Various factors may influence the duration of a CT scan workflow. Some of these factors present opportunities for introducing efficiencies, such as in the preparation related to ambulatory or non-ambulatory patients or other vendor provided solutions. Further work can result in a better working environment for the staff and experience for the patients.

ACKNOWLEDEMENTS
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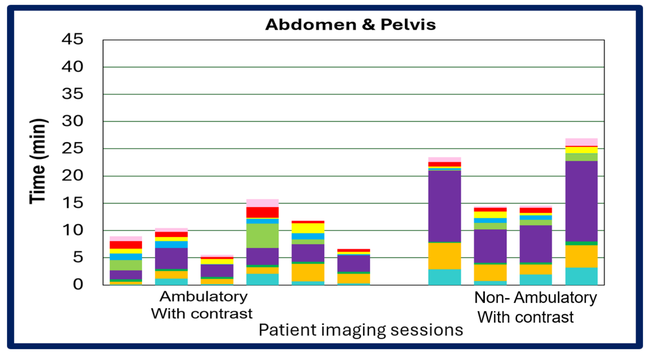

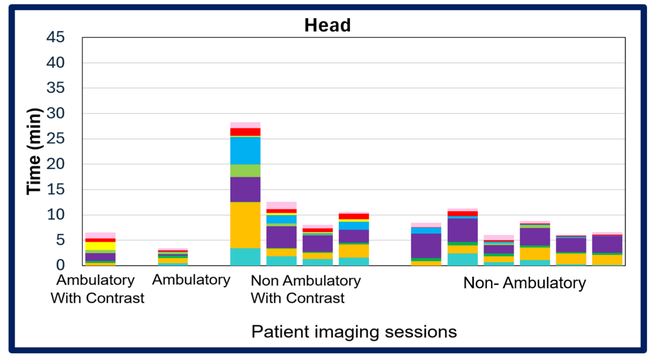

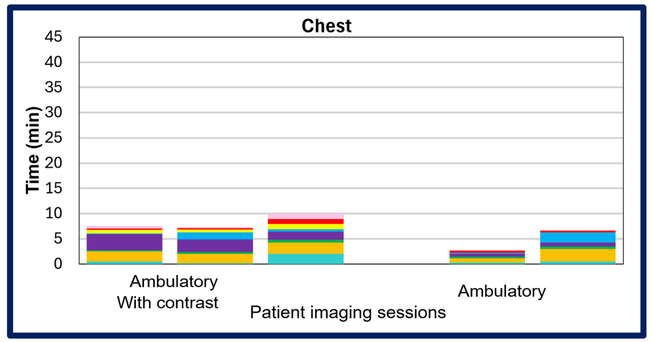

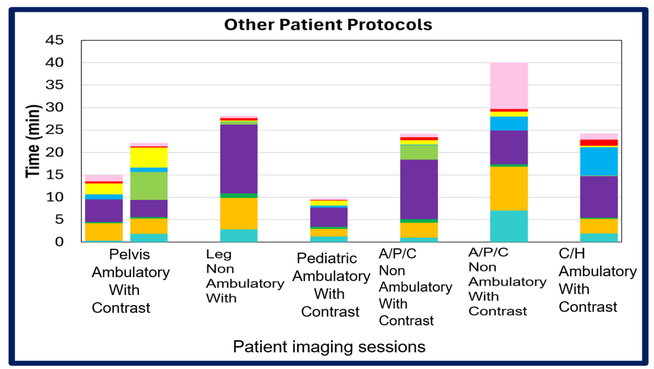

Pre-arrival
Contacting nurse, arranging transportation, and checking labs
Average Time: 1 +/- 1.42 min

Patient Preparation
Verifying the identity, checking IV, contrast flush if needed
Average Time: 4.8 +/- 4.0 min

Patient Positioning
Positioning patient in the gantry for the scan acquisition
Average Time: 0.4 +/- 0.18 min

Set-up Protocol
Picking the Scanning region and protocol
Average Time: 1 +/- 1.7 min

Acquisition planning
Manually adjusting delay times or scout view if needed
Average Time: 1.3 +/- 1.8 min

Saline contrast injection
Saline or contrast is injected into patient
Average Time: 0.7 +/- 0.9 min

Scan
When the patient moved in and out of gantry
Average Time: 0.6 +/- 0.4 min

Patient exit
Patient to exits the scanning room
Average Time: 2.7 +/- 2.2 min

Post scan tasks
Image review, and documentation
Average Time: 0.8 +/- 1.4 min

Figure 2. CT Imaging workflow time across elements. Each plot represents a different type of CT protocol. The graphs represents the overall time for each individual patient imaging session (minutes) for each recorded element during the investigation. Each bar represents a different patient (N=34) imaging session. Each color corresponds to a distinct workflow element, showing variability and time distribution across different clinical protocols including with or without contrast and patient mobility (ambulatory or non-ambulatory)

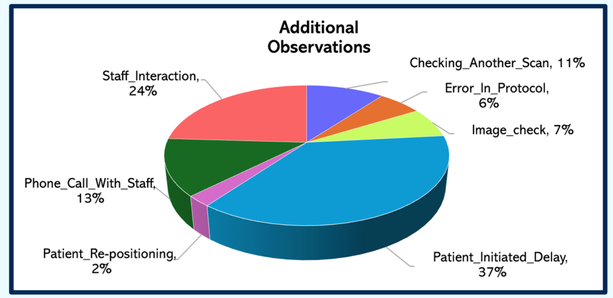

Figure 3. Additional observations were observed and tracked, but omitted from analysis because of high variability such as error in protocols, Image check, Patient initiated delays, Patient re-positioning, Phone-call with staff, Staff interaction Not included: Patient transport. Percentages represent each category's share of the total of around 60 minutes of disruptions observed across the multiple patient imaging sessions.

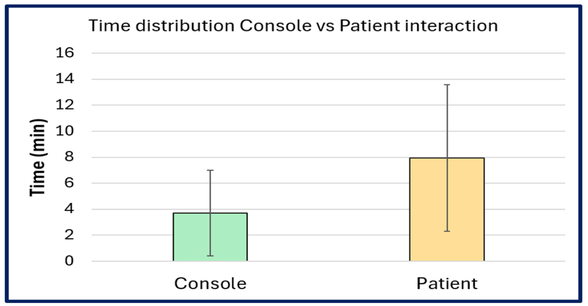

Figure 4. CT Imaging workflow time distribution across time spent on console in control room vs interaction with patient. Contributing workflow time elements bracketed in Figure 2 (left)