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Cedars Sinai

Leveraging Dose Tracking Software to Monitor CT Repeat Rates: A Multi-Protocol Analysis

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Background

Repeat rates are analyzed in digital radiography and mammography, but computed tomography repeat rate data remains limited [1]. Efforts have been made to use DICOM metadata to identify repeats, but accessing and parsing large amounts of DICOM data poses challenges [2]. The goal of this study was to mitigate these challenges by utilizing data from a dose tracking software to retrospectively track repeat rates for frequently used CT exams.

Impact

The use of dose tracking software offers a method for institutions to monitor CT repeat rates. This aids in identifying non-protocol factors that increase patient dose, allowing for targeted training.

References

[1] Jones AK, Heintz P, Geiser W, Goldman L, Jerjian K, Martin M. Ongoing quality control in digital radiography: Report of AAPM imaging physics committee task group 151. Med Phys. 2015; 42(11): 6658–6670.

[2] Rose S, Viggiano B, Bour R, Bartels C, Kanne JP, Szczykutowicz TP. Applying a New CT Quality Metric in Radiology: How CT Pulmonary Angiography Repeat Rates Compare Across Institutions. J Am Coll Radiol. 2021 Jul;18(7):962-968.

Methods

Data was exported from a dose tracking system (DTS) (Imalogix) for head without contrast, abdomen pelvis with contrast, and chest without contrast exams performed on 15 scanners over 4 years. Additionally, coronary CT angiography data were utilized for a wide-beam scanner over 2 years. 174,605 exams were included in the analysis done with Python. Due to acquisition-level protocol mapping in the DTS, only relevant acquisitions to the protocol category in multiple-series exams were assumed to remain in the data. To account for true repeats, $CTDI_{vol}$ and scan-length thresholds were used to exclude incorrectly mapped scout, bolus-tracking, and other acquisitions. The number of acquisitions (NOA) was assigned corresponding to each exam. The data were grouped by protocol name, and the most frequent appearing NOA in each group was deemed the "normal NOA". Any exam with a NOA greater than the normal NOA was deemed a repeat. Data was analyzed monthly. Repeated exams were carefully reviewed in PACS to validate the method.

Figure 1: Workflow to extract repeat exams from dose tracking data

Results

Monthly repeat rates ranged from 1.9-3.8% (Head WO), 2.9-6.4% (Abdomen Pelvis W), 0.5-5.8% (Chest WO), and 0-3% (CCTA). Investigation into individual exams showed repeats were often due to patient motion. The discovery of unjustified repeats due to technologist errors led to one-on-one retraining. The repeat rate for the chest protocol decreased, while the rate for head, abdomen pelvis, and CCTA protocols remained steady.

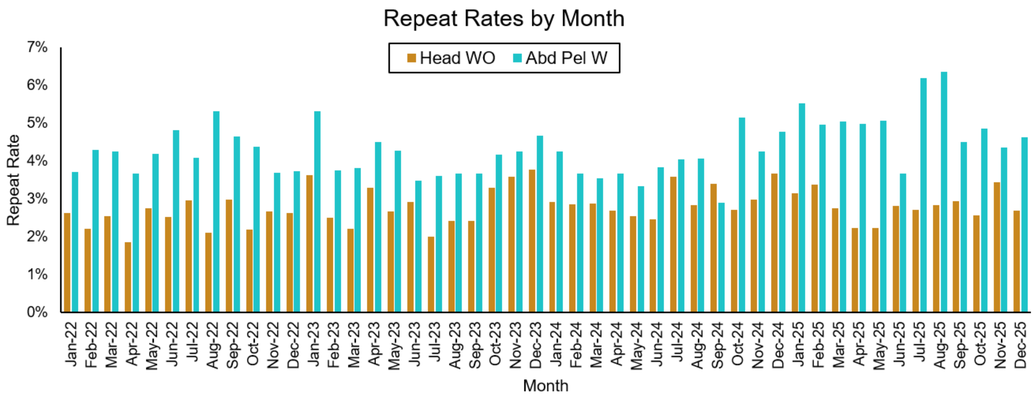

Figure 2: Repeat rates by month for Head WO and Abdomen Pelvis W protocols

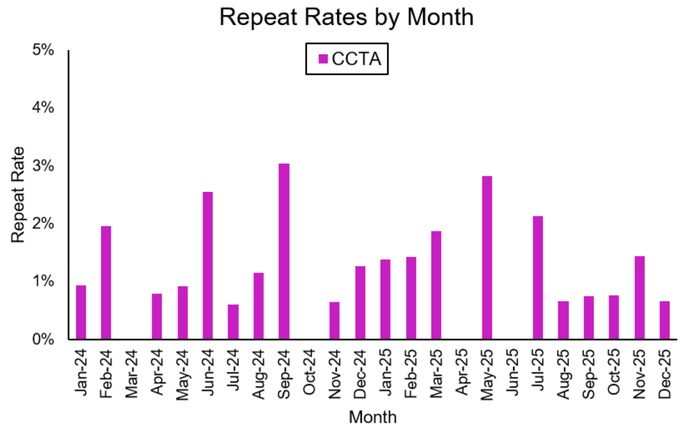

Figure 3: Repeat rates by month for Chest WO protocol

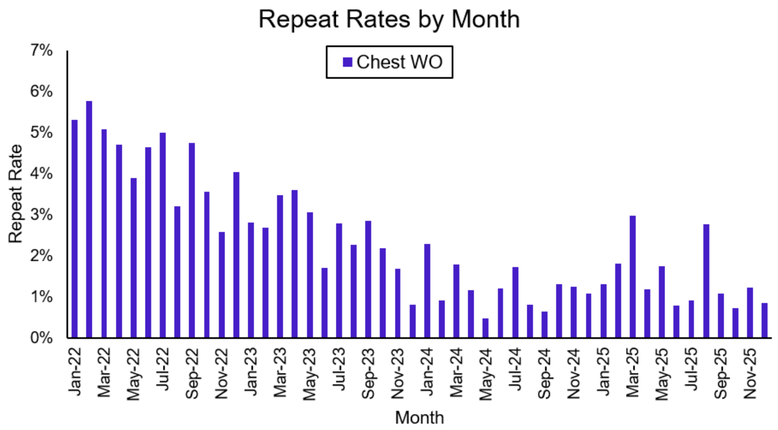

Figure 4: Repeat rates by month for CCTA

Conclusion

Utilizing data from a DTS provides a unique opportunity for institutions to track CT repeat rates. Tracking CT repeat rates may lead to insights into factors outside of the protocol parameters that lead to excess patient dose. In alignment with ALARA, retraining efforts are in progress to try to reduce unjustified repeats.