Exploring Discrepancies between Radiation Dose Structured Reports and Dose Sheets Radiation Reports for Fluoroscopy Procedures

[1] Ashima Kundu, BS, [2] Sachin Govind, BS, [3] Judy James, PhD
[1] Loyola University Chicago Stritch School of Medicine, Maywood IL,
[2] Northwestern University Feinberg School of Medicine, Chicago IL,
[3] Loyola University Medical Center, Department of Radiology, Maywood IL

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ABSTRACT

Purpose: Accurate radiation documentation is essential for assessing patient risk during fluoroscopically guided procedures. Radiation dose summary pages ("Dose Sheets") are commonly used but may omit exposure details while DICOM Radiation Dose Structured Reports (RDSRs) provide more comprehensive event-level data. Quantifying differences between these reporting methods is important for understanding dose monitoring accuracy.

Materials and Methods: We retrospectively analyzed 29,957 radiation events from 605 consecutive fluoroscopy procedures performed for patients over a six-month period at a tertiary academic medical center. Data entries were analyzed to note discrepancies in radiation doses reported in the form of RDSRs and Dose Sheets.

Results: Significant discrepancies were found between RDSR and Dose Sheets across all scanners. On average, Dose Sheets only captured 29.8% of the procedure total radiation and excluded some key imaging variables if the entry had a lower radiation dose, lower DAP, larger collimated field area, or higher tube voltage, that were always reported in the RDSR (p<0.001). Another interesting finding was that the radiation events were most accurately accounted for in peripheral angiograms (69.9%) and least accurately reported in IVC filter placements (0.6%).

Multi-variate analysis showed that the higher tube voltage variable was more likely to be excluded on the Dose Sheets while higher radiation dose and higher tube current-time product values (mAs) would always be reported in both Dose Sheets and RDSR. ROC model indicated strong performance (AUC=0.84), in effectively distinguishing between RDSR entries that were captured versus omitted on the Dose Sheet. Device-dependent variations across both devices were also observed which included capture proportions of 54.8% (device1) versus 8.0% (device2), indicating that underreporting is influenced by vendor settings implementation rather than physician preference or protocol selection.

Conclusions: Dose Sheets systematically underreport radiation exposure, often omitting low-dose and collimated events. Referencing RDSR-based documentation over Dose Sheets may improve exposure assessment, enhance dose accuracy, and radiation safety practices.

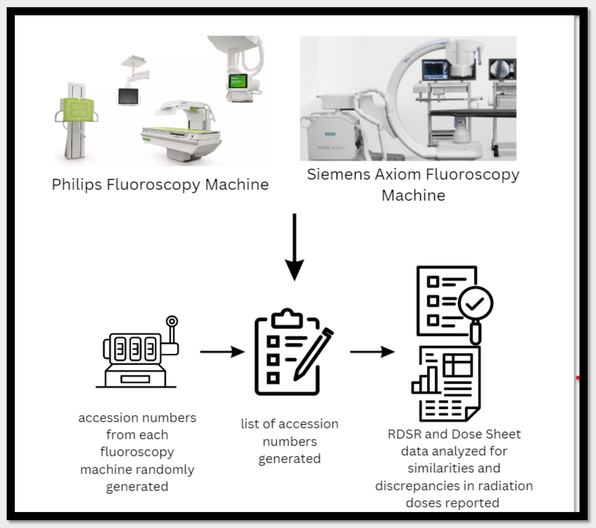
Judy James, PhD
Loyola University Medical Center,
Department of Radiology
2160 S 1st Ave
Maywood, IL, 60153
708-216-3779
Judy.james@lumc.edu

INTRODUCTION

- Diagnostic and treatment modalities utilizing radiation (such as fluoroscopy) are routine procedures in medicine
- Fluoroscopic procedures use continuous or pulsed X-rays to provide real-time visualization of internal structures
- Excessive radiation can be harmful and several radiation monitoring reports, including the Radiation Dose Structured Report (RDSR) and Dose Sheet, are used to track radiation exposure
- Problem: RDSR and Dose Sheets have differing standards regarding which exposures are reported leading the potential for certain reports to report incomplete data sets which might mislead clinicians about the radiation doses their patients are receiving
- Purpose: this project explores some of the discrepancies between RDSR and Dose Sheet reports across different types of scanners in how events and exposures are listed

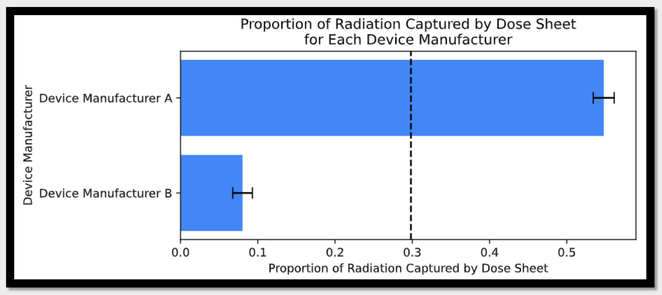
MATERIALS & METHODS

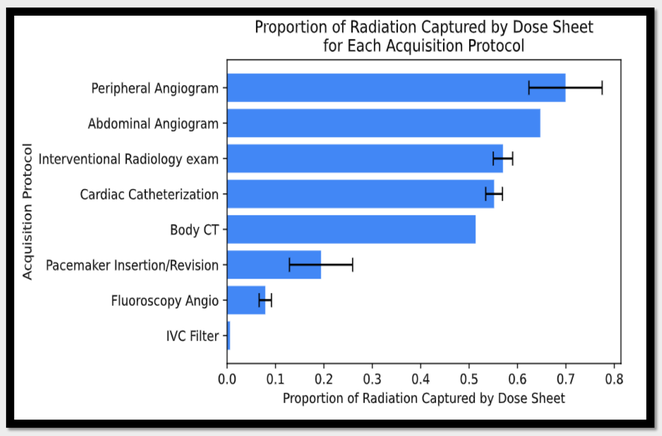
RDSR and Dose Sheet data was acquired from radiation dose monitoring software for randomly-selected accession numbers from all three fluoroscopy machines from the Interventional Radiology department at Loyola University Medical Center.

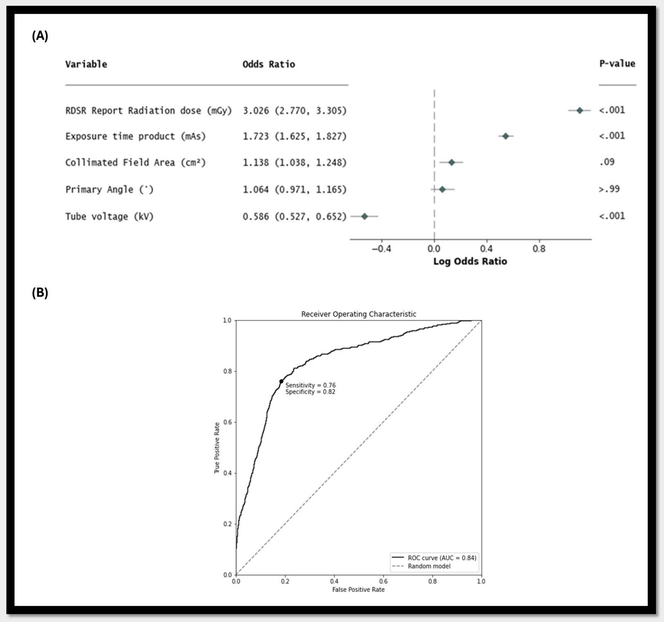


RESULTS & DISCUSSIONS

- A total of 605 fluoroscopy procedures comprising 29,957 radiation events were analyzed over a 6-month period.
- Dose Sheets captured only 29.8% of total radiation exposure on average, indicating substantial underreporting compared with RDSRs.
- Radiation capture varied significantly by device manufacturer:
  - Manufacturer A: 54.8% captured
  - Manufacturer B: 8.0% captured
- The RDSR entries that were excluded from the Dose Sheet (p<0.001) were the ones that had lower radiation dose, lower DAP, larger collimated field area, or higher tube voltage.
- Radiation capture varied substantially by procedure type:
  - Peripheral angiograms: 69.9%
  - Abdominal angiograms: 64.7%
  - Cardiac catheterizations: 55.2%
  - Angiography procedures: 7.8%
  - IVC filter placements: 0.6%
- Multivariable analysis demonstrated that higher radiation dose (OR = 3.03, 95% CI 2.77-3.30) and higher mAs (OR = 1.72, 95% CI 1.62-1.83) increased the likelihood of Dose Sheet capture, while higher tube voltage decreased the likelihood of capture (OR = 0.59, 95% CI 0.53-0.65).
- The predictive model demonstrated strong performance (AUC = 0.84, sensitivity = 76%, specificity = 82%) in effectively distinguishing between RDSR entries that were captured versus omitted on the Dose Sheet .







CONCLUSIONS

- This study discovered sizable discrepancies in the total radiation dose inferred from RDSR and Dose Sheet data from various fluoroscopy devices.
- Because physicians typically use Dose Sheets to monitor procedural radiation doses, these discrepancies should be further characterized to discern differences in the accuracy of the reports and characterize the nature of the differences.
- This investigation identified RDSR as the preferred dose reporting scheme (required for Peak Skin Dose calculations), because it captures more dose information
- Limitations of the project included the limited patient size analyzed in the study and confounding factors such as differential amount of radiation that is included in different procedure protocols
- Future experiments can include doing this investigation with a larger sample size

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