Exam Type-Driven Variations in MRI Efficiency: Throughput, Billing, and RVU Across a Multi-Site Academic Health System

Linh Nguyen MS[1], Sina Rasti MD[2], Joseph Kim MD[3], Long Tu MD[3]

1.University of the Incarnate Word School of Osteopathic Medicine, San Antonio, TX
2.Department of Radiology, Sina Hospital and Heart Center, Isfahan, Iran
3.Yale Department of Radiology & Biomedical Imaging; New Haven, CT, USA

Background

- MRI is a time-intensive and costly imaging modality in modern healthcare.
- System-level data on reimbursement and work relative value units (RVUs) per unit of scanning time remain limited in the published literature.
- Existing studies often focus on overall RVU productivity or broad modality costs, but few quantify variations by specific CPT/procedure code across large multi-site systems.
- This study analyzes procedure code–specific variations in a large academic health system to identify opportunities for optimizing throughput, revenue, and MRI protocols.

Figure 1. MRI Data Processing and Analysis Workflow

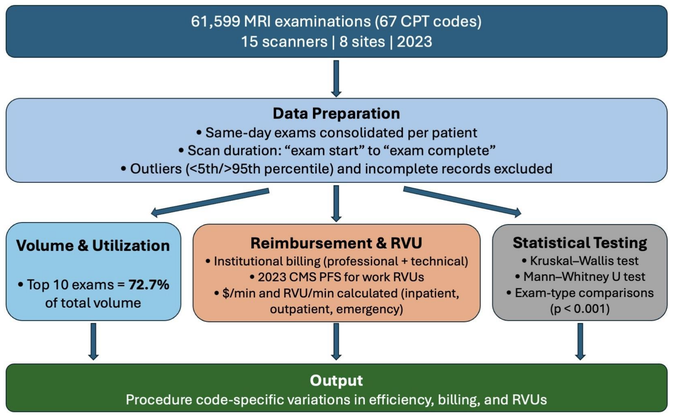


Figure 1. Data were aggregated by CPT code to calculate volume contribution, reimbursement, and RVU per scanner minute. Differences by exam type were assessed using Kruskal–Wallis and Mann–Whitney U tests.

Methods

We analyzed one year of MRI data (Jan. 1 – Dec. 31, 2023) from 15 scanners across 8 sites in a large academic health system. Same-day examinations per patient were consolidated. Scan duration was defined from "exam start" to "exam complete," excluding outliers (<5th or >95th percentile) and incomplete records.

Conclusion

In this large multi-site analysis of 61,599 MRI examinations, reimbursement and RVU productivity per scanner minute varied substantially across procedure codes. High-volume brain and spine exams generated significantly lower financial efficiency compared with abdominopelvic protocols, despite comprising the majority of scanner utilization.
These findings highlight important opportunities to optimize MRI throughput and revenue by targeting high-volume, lower-efficiency protocols through protocol standardization, workflow improvements, and selective scheduling adjustments.

Future Directions

- Evaluate the impact of targeted protocol optimization on scanner throughput and revenue
- Assess the feasibility of shifting select low-efficiency exams to alternative imaging modalities
- Expand this analysis across additional health systems to establish broader benchmarks

Results

Reimbursement and work RVUs per scanner minute varied significantly across the 67 MRI procedure codes.

- The top 10 most frequent exam types accounted for **72.7%** of total MRI volume.
- High-volume brain and spine exams generated **significantly lower** outpatient reimbursement and RVUs per scanner minute compared with abdominopelvic exams.
- Abdominopelvic protocols showed the highest efficiency ($6.96–$12.81 per minute; 0.19–0.35 RVU/min), while non-contrast spine and lower-extremity joint exams had the lowest ($4.43–$9.14 per minute; 0.12–0.23 RVU/min).
- Overall, MRI scanning averaged **$8.40 reimbursement** and **0.29 RVU** per scanner minute across all examinations.

Figure 2. Top 10 Most Frequently Performed MRI Exam Types

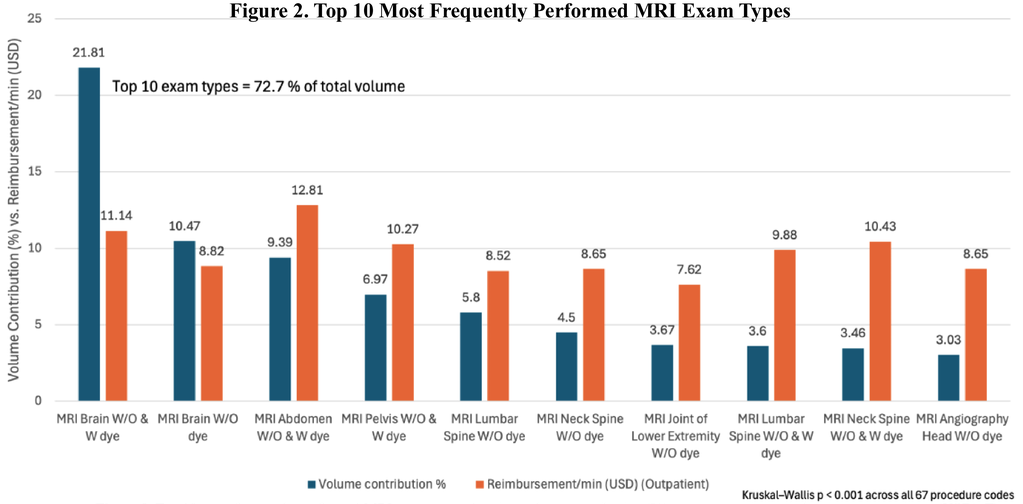
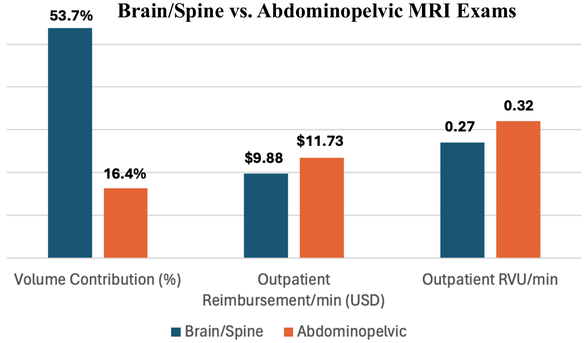


Figure 2. Top 10 most frequently performed MRI exam types showing volume contribution (%) versus outpatient reimbursement per minute (USD). The top 10 exams account for 72.7% of total volume. Kruskal–Wallis p < 0.001 across all 67 procedure codes.

Figure 3. Reimbursement Efficiency Comparison: Brain/Spine vs. Abdominopelvic MRI Exams



Abdominopelvic exams deliver higher reimbursement & RVU per scanner minute despite much lower volume share — key opportunity for protocol optimization, throughput & revenue.

Mann-Whitney U test p ~ 0.001 (group comparison). Data aggregated from institutional billing + 2023 CMS PFS.

Figure 3. Comparison of scanner-time efficiency metrics between major MRI exam categories. Volume contribution % is calculated across all settings (Inpatient + Outpatient + Emergency).

Table 1. The Top 10 MRI Exams: Volume Contribution and Outpatient Reimbursement/RVU per Minute

CPT Code	The top 10 most frequently performed MRI exams	Volume contribution %	Outpatient Billing (USD/min)	Outpatient RVU/min
70553	MRI Brain W/O & W dye	21.81	11.14	0.30
70551	MRI Brain W/O dye	10.47	8.82	0.24
74183	MRI Abdomen W/O & W dye	9.39	12.81	0.35
72197	MRI Pelvis W/O & W dye	6.97	10.27	0.28
72148	MRI Lumbar Spine W/O dye	5.80	8.52	0.23
72141	MRI Neck Spine W/O dye	4.50	8.65	0.23
73721	MRI Joint of Lower Extremity W/O dye	3.67	7.62	0.21
72158	MRI Lumbar Spine W/O & W dye	3.60	9.88	0.27
72156	MRI Neck Spine W/O & W dye	3.46	10.43	0.28
70544	MRI Angiography Head W/O dye	3.03	8.65	0.23

Table 1. Top Volume contribution % is calculated across all settings (Inpatient + Outpatient + Emergency). Reimbursement and RVU values are shown for the Outpatient setting only. Kruskal–Wallis p < 0.001 across all 67 procedure codes.