



EMORY
UNIVERSITY

Day of Week, Site of Service, and Patient Complexity Disparities in Musculoskeletal MRI Interpretations by Radiologists vs. Non-Radiologists

Paul Harkey, MD
Paige Sharp, MD
Wenyi Wang, MA
Danny Hughes, PhD
Neil Lall, MD
Richard Duszak, Jr., MD



Department of Radiology
Emory University School of Medicine
Atlanta, GA



Ochsner[™] Ochsner Health System
Radiology New Orleans, LA



Harvey L. Neiman Health Policy Institute
Reston, VA

Financial Disclosures

- Dr. Duszak receives research support from the Harvey L. Neiman Health Policy Institute. Otherwise, the authors have no relevant financial disclosures.



Background

- Utilization of musculoskeletal (MSK) imaging has increased substantially over the last two decades.
- In the Medicare population, extremity MRI has soared by more than 600%, with radiologists consistently the dominant providers [1].
- Orthopedic surgeons have dramatically increased billing for musculoskeletal imaging examination interpretations and are the second most common provider group for these services.



Purpose

- Determine differences in practice patterns between radiologists and non-radiologists who interpret lower extremity MRIs on Medicare beneficiaries.
- Identify areas where radiologists offer unique value.
- Use this data to promote further research and inform future pay for performance metrics.



Methods: Data Source

- Using research identifiable file carrier claims data (RIFs), we identified all claims for lower extremity joint MRI examinations from 2012-2014.
 - The RIFs contain all fee-for-service claims for a 5% national sample of Medicare enrollees—approximately 2.5 million beneficiaries—and contains patient demographic information as well as provider identify, provider specialty, date, and site of service.
- Services were classified by specialty of billing physician, day of week of service, and site of service.
- Patient complexity scores were assigned to all patients using calculated Charlson Comorbidity Indices (CCI).
- All analyses were performed using SAS version 9.4 for Windows (SAS Institute, Inc.) and Excel 2013 (Microsoft). Chi square analysis was used to determine statistical significance. Statistical tests were two-sided with an alpha level of 0.05.



Methods: Identifying Relevant Studies

- Current Procedural Terminology (CPT) codes for MRI lower extremity were identified within the data set for calendar years 2012, 2013, and 2014.
 - MRI lower extremity without contrast: 73721
 - MRI lower extremity with contrast: 73722
 - MRI lower extremity with and without contrast: 73723



Methods: Identifying Providers

- For each claim, the billing physician specialty was classified as radiologist, non-radiologist, or undetermined.
- Radiologists were identified by specialty codes:
 - Interventional radiology (94)
 - Diagnostic radiology (30)
 - Nuclear medicine (36)
- For some services, provider specialties could not be uniquely determined (i.e. those billing using generic multi-specialty clinic codes).
- All other services were attributed to non-radiologists.



Methods: Identifying Location and Day of Week

- Patient location was identified by site specific codes:
 - Emergency department (23)
 - Inpatient hospital (21)
 - Outpatient hospital (23)
 - Private office (11)
 - All other much lower volume sites were grouped together.
- Each date of service was isolated and mapped to a day of week, and further categorized as a weekday (Monday through Friday) or weekend (Saturday and Sunday).



Methods: Calculating Charlson Comorbidity Index

- CCI is used to determine patient mortality based on specific diagnoses identified with the International Classification of Disease (ICD) lexicon [2].
 - Higher scores indicate higher mortality risk and are commonly used by health services researchers as surrogates for overall patient complexity.
- Using each imaged Medicare beneficiary's claims data for a single year prior to MRI claim (2011 through 2013), a Charlson Comorbidity Index (CCI) score was calculated (0, 1, 2, or 3+).

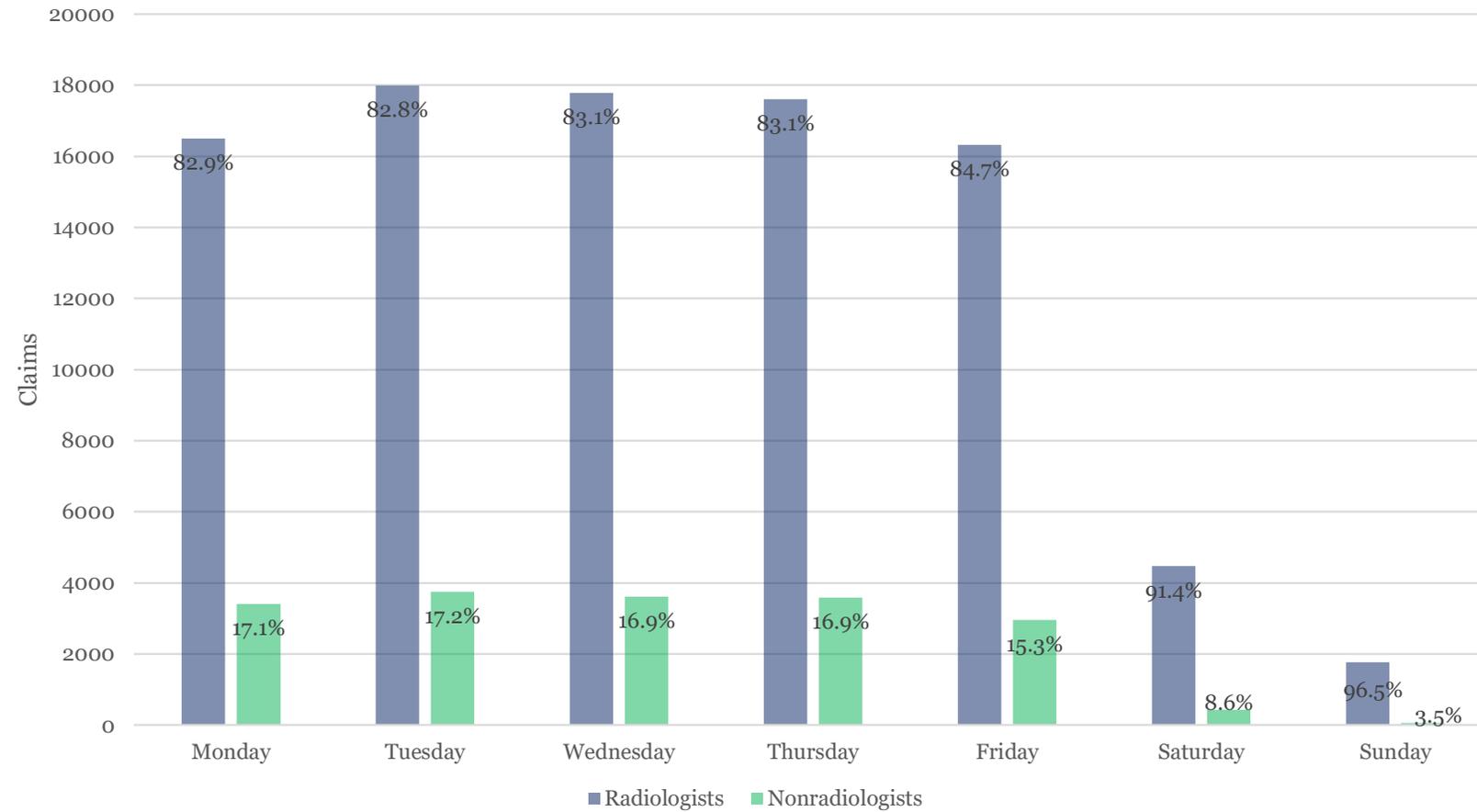


Results: Day of Week

- Of all 125,800 lower extremity joint examinations, 92,203 (73.3%) were interpreted by radiologists and 17,745 (14.1%) by non-radiologists.
 - A rendering provider specialty could not be unambiguously determined for 15,852 (12.6%).
- Of weekday examinations for which a provider specialty could be identified, radiologists interpreted 85,991 (83.3%) and non-radiologists 17,260 (16.7%).
- Of weekend examinations, radiologists interpreted 6,212 (92.8%) and non-radiologists 485 (7.2%). ($p < 0.0001$)



Weekend vs. Weekday: Specialty



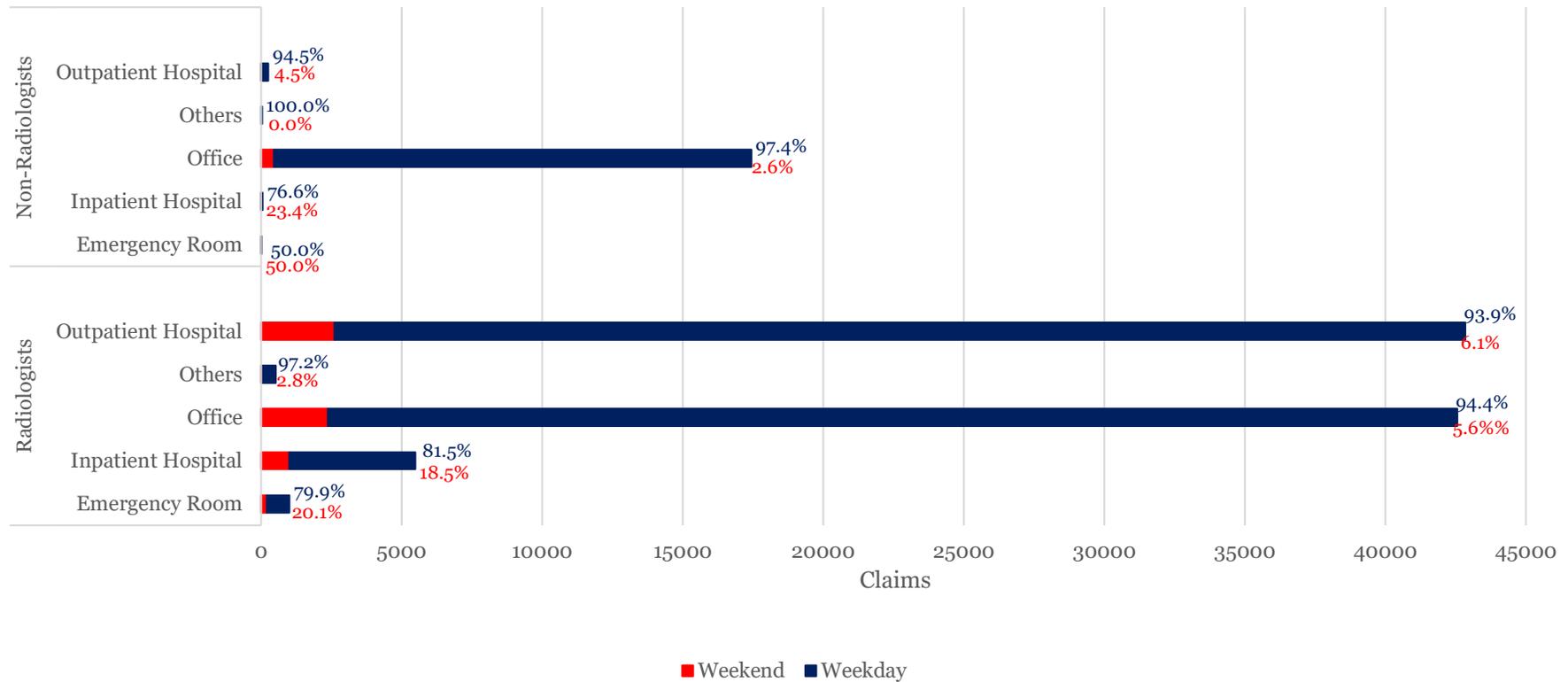
Results: Site of Service

- Location for which a provider specialty could be unambiguously identified:
 - Private office—60,007 (54.4%)
 - Inpatient—5,536 (5.0%)
 - Outpatient—43,105 (39.1%)
 - Emergency department—1,014 (0.9%)
 - All other sites—562 (0.5%)
- Radiologists interpreted 6,499 (99.2%) of examinations in the inpatient hospital and emergency department setting vs. 51 (0.8%) for non-radiologists.
- Of claims by non-radiologists, 16,981 (95.5%) were for studies performed in the office setting during the week. ($p < 0.0001$)



Weekend vs. Weekday: Site of Service

2012-2014



Results: Patient Complexity

- Of all MRI lower extremity examinations for which a provider specialty could be unambiguously identified, the majority (87.8%) were performed on patients with no identifiable comorbidities (CCI=0).
 - For CCI=0, radiologists interpreted 87.1% vs 90.1% for non-radiologists.
 - For CCI=1, radiologists interpreted 4.4% vs 4.3% for non-radiologists.
 - For CCI=2, radiologists interpreted 3.1% vs. 2.5% for non-radiologists.
 - For $CCI \geq 3$, radiologists interpreted 5.4% vs. 3.1% for non-radiologists.
- Average CCI:
 - 0.36 for radiologist studies vs. 0.23 for non-radiologists studies. ($p < 0.0001$)



Discussion

- While radiologists interpret the majority of lower extremity MRI examinations, the use of patient-level claims data in our study provides new insight into the characteristics of services performed by different specialty groups.
- Our study demonstrates that radiologists disproportionately provide lower extremity joint MRI interpretation services on weekends, on patients in the highest acuity locations, and on the most clinically complex patients in our Medicare sample.



Discussion

- In our cohort, radiologists provided greater than 80% of weekend services for lower extremity MRI, which represented a greater than 10% relative increase compared to weekday work.
- In contrast, relative volumes of weekend work by non-radiologists decreased 55% compared with their weekday volumes.
- For reasons not entirely clear, Tuesdays were the busiest day for both groups and Fridays were the least busy.
 - isproportionate decrease in non-radiologists volumes on Fridays by more than 20%, suggesting an “extended weekend” workflow phenomenon.



Discussion

- Radiologists disproportionately provide services in the highest acuity setting.
 - They interpret greater than 99% of examinations in the inpatient hospital, outpatient hospital, and ED settings.
 - Radiologists likely disproportionately provide more evening and overnight services given they provide the majority of interpretations in the inpatient setting.
- Radiologists disproportionately provide services in the highest acuity patients as demonstrated by CCI.
 - For $CCI \geq 3$, radiologists interpreted 5.4% vs. 3.1% for non-radiologists.



Limitations

- 5% Medicare carrier claims dataset may not be generalizable to non-Medicare populations.
- Since we used data for paid claims, we are unable to identify cases that subspecialists initially billed, and then asked a radiologist to unofficially re-review or provide a “curbside” consult.
 - There may actually be an even greater number of interpretations performed by radiologists in more complex patients.
- Claims data do not permit us to determine the time of day a service was rendered (e.g., 2am and 2pm services on the same date are indistinguishable).



Take Home Points

- Utilization of musculoskeletal imaging has increased substantially over the last two decades.
- While radiologists are the dominant provider for interpretation services, non-radiologists also provide these services.
- Compared with non-radiologists, radiologists disproportionately provide their services on weekends, on patients in the highest acuity locations, and on the most clinically complex patients.
- To promote patient access and minimize disparities, future pay-for-performance metrics should consider temporal, acuity, and complexity parameters.



References

- Gyftopoulos S, Harkey P, Hemingway J, et al. Changing Musculoskeletal Extremity Imaging Utilization From 1994 Through 2013: A Medicare Beneficiary Perspective. *AJR Am J Roentgenol.* 2017;209(5):1103-1109.
- Lu MT, Hallett TR, Hemingway J, et al. Secondary Interpretation of CT Examinations: Frequency and Payment in the Medicare Fee-for-Service Population. *J Am Coll Radiol.* 2016;13(9):1096-101.
- Quan H, Sundararajan V, Halfon P, et al. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. *Med Care.* 2005;43(11):1130-9.
- Rosenkrantz AB, Hughes DR, Duszak R. How Do Publicly Reported Medicare Quality Metrics for Radiologists Compare With Those of Other Specialty Groups?. *J Am Coll Radiol.* 2016;13(3):243-8.
- Rosenkrantz AB, Hughes DR, Duszak R. Medicare Claims Data Resources: A Primer for Policy-Focused Radiology Health Services Researchers. *J Am Coll Radiol.* 2017 Dec;14(12):1538-1544.
- Silva E, Mcginty GB, Hughes DR, et al. Alternative Payment Models in Radiology: The Legislative and Regulatory Roadmap for Reform. *J Am Coll Radiol.* 2016;13(10):1176-1181.
- Silva E, Mcginty GB, Hughes DR, et al. Traditional Payment Models in Radiology: Historical Context for Ongoing Reform. *J Am Coll Radiol.* 2016;13(10):1171-1175.



Thank you!

Any questions or comments can be directed to
paul.p.harkey@emory.edu.

