

A County-Level Analysis of the US Radiologist Workforce: Physician Supply and Subspecialty Characteristics

Andrew B. Rosenkrantz, MD, MPA^a, Wenyi Wang, MA^b, Danny R. Hughes, PhD^{b,c},
Richard Duszak Jr, MD^d

Abstract

Purpose: To explore associations between county-level measures of radiologist supply and subspecialization and county structural and health-related characteristics.

Methods: Medicare Physician and Other Supplier Public Use Files were used to subspecialty characterize 32,844 radiologists participating in Medicare between 2012 and 2014. Measures of radiologist supply and subspecialization were computed for 3,143 US counties. Additional county characteristics were identified using the 2014 County Health Rankings database. Mann-Whitney tests and Spearman correlations were performed.

Results: Counties with at least one (versus no) Medicare-participating radiologist had significantly ($P < .001$) larger populations ($197,050 \pm 457,056$ versus $20,253 \pm 23,689$), lower rural percentages ($39.5\% \pm 26.5\%$ versus $74.6\% \pm 25.6\%$), higher household incomes ($\$47,608 \pm \$12,493$ versus $\$42,510 \pm \$9,893$), higher mammography screening rates ($62.4\% \pm 7.0\%$ versus $56.6\% \pm 15.3\%$), and lower premature deaths ($7,581 \pm 2,085$ versus $7,784 \pm 3,409$ years of life lost). Counties' radiologists per 100,000 population and percent of subspecialized radiologists showed moderate positive correlations with counties' population ($r = +0.505$ – $+0.599$) and moderate negative correlations with counties' rural percentage ($r = -0.434$ to -0.523). Radiologist supply and degree of subspecialization both showed concurrent positive or negative weak associations with counties' percent age 65+ ($r = -0.256$ to -0.271), percent Hispanic ($r = +0.209$ – $+0.234$), and income ($r = +0.230$ – $+0.316$). Radiologists per 100,000 population showed weak positive correlation with mammography screening ($r = +0.214$); percent of radiologists subspecialized showed weak negative correlation with premature death ($r = -0.226$).

Conclusion: Geographic disparities in radiologist supply at the community level are compounded by superimposed variation in the degree of subspecialization of those radiologists. The potential impact of such access disparities on county-level health warrants further investigation.

Key Words: Radiologist workforce, physician supply, subspecialization, Medicare, health policy

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^aDepartment of Radiology, NYU Langone Medical Center, New York, New York.

^bHarvey L. Neiman Health Policy Institute, Reston, Virginia.

^cDepartment of Health Administration and Policy, George Mason University, Fairfax, Virginia.

^dDepartment of Radiology and Imaging Sciences, Emory University School of Medicine, Atlanta, Georgia.

Corresponding author and reprints: Andrew B. Rosenkrantz, MD, Department of Radiology, Center for Biomedical Imaging, NYU School of Medicine, NYU Langone Medical Center, 660 First Avenue, 3rd Floor, New York, NY 10016; e-mail: Andrew.Rosenkrantz@nyumc.org.

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INTRODUCTION

The optimal composition of the national radiology workforce has been a long-standing topic of interest within the specialty [1,2]. Current and future manpower needs are best addressed by a complete and nuanced understanding of the composition of the existing national workforce. One recent analysis demonstrated large state-to-state variation in the supply of radiologists [3]. In that study, radiologist supply was relatively limited in more rural states, suggesting a role for better geographic redistribution to help improve access to care [3]. However, beyond the actual number and geographic distribution of radiologists, it is also important to consider the varied work patterns of each

community's radiologists. Across the country, radiologists' practices are becoming increasingly subspecialized [4]. Although radiologists' precise degree of subspecialization varies considerably, recent work demonstrates that both academic and private practice radiologists can be reliably classified as either majority generalists or majority subspecialists [5,6]. For a variety of reasons, patient care may best be advanced through robust access to both generalist and subspecialist radiologists. Nonetheless, although geographic patterns of radiologist supply overall have received recent attention, geographic patterns of radiologist subspecialization are not well known. In this study, aiming to inform initiatives to rightsize the US radiologist workforce, we explore associations between county-level measures of radiologist supply and subspecialization and county structural and health-related characteristics.

METHODS

Subjects

This study, based on publicly available data sets, did not use private health identifiable information, did not represent human subjects research, and therefore did not require oversight by our institutional review boards. Our study sample consisted of all radiologists submitting claims to Medicare between 2012 and 2014 as identified in the Medicare Provider Utilization and Payment Data: Physician and Other Supplier Public Use File. Combining claims information from all 3 years, we identified an initial sample of 33,118 radiologists (defined as a physician with a CMS listed primary specialty of diagnostic radiology, interventional radiology, or nuclear medicine [7-9]). Radiologists from the following groups were excluded from subsequent analysis: (1) no listed billable work relative value units (wRVUs) ($n = 28$), (2) practice location outside of the 50 states or Washington DC ($n = 238$), or (3) a listed zip code for which a corresponding county could not be identified ($n = 8$), thus providing a final included sample of 32,844 radiologists.

Radiologist Subspecialization

For included radiologists, the Physician and Other Supplier Public Use File was used to obtain the total number of billed claims from 2012 to 2014 for individual services identified by Healthcare Common Procedure Coding System codes [10]. The Neiman Imaging Types of Service [11], which provides detailed classification of noninvasive diagnostic imaging services, was used to map these services' wRVUs to specific modalities and

body regions, and the Neiman Imaging Types of Service categories associated with radiologists' wRVUs were then assigned to individual subspecialties using a previously described system [5,6]. As in those works, Berenson-Eggers Imaging Types of Service categorization was additionally used to identify invasive procedures performed by interventional radiologists. The maximal percent of billed wRVUs in a single subspecialty was determined for each radiologist. Based on prior published definitions [5,6], radiologists for whom over 50% of their billed Medicare wRVUs were in a single subspecialty were classified as majority subspecialists, and those with up to 50% of billed wRVUs in a single subspecialty were deemed majority generalists (those prior investigations demonstrated this 50% threshold to achieve an error rate of under 5% in assigning radiologists to individual subspecialties) [5].

For the zip code provided by CMS for each radiologist's practice location, the corresponding Federal Information Processing Standards county code was identified [12,13]. The following aggregate measures were then computed for 3,143 counties in the 50 states and Washington DC [14]:

- Total number of radiologists
- Total number of generalist radiologists
- Total number of subspecialist radiologists
- Percent of radiologists in the county who are subspecialized
- Radiologists' average percent of billed wRVUs in a single subspecialty

The final two measures were computed only among those counties with at least one Medicare-participating radiologist.

County-Level Characteristics

Additional information for all counties was obtained by cross-referencing county Federal Information Processing Standards codes to the 2014 County Health Rankings & Roadmaps database [15]. This database, developed by the Robert Wood Johnson Foundation and University of Wisconsin Population Health Institute, contains information on a wide range of measures related to counties' social, economic, and health status, pooled from a spectrum of sources. The following measures were recorded:

- Population
- Percent female (hereafter "female")
- Percent aged 65 or older (hereafter "age 65+")

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