

Physician Specialty and Radiologist Characteristics Associated with Higher Medicare Patient Complexity

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Rationale and Objectives: Meaningfully measuring physician outcomes and resource utilization requires appropriate patient risk adjustment. We aimed to assess Medicare patient complexity by physician specialty and to further identify radiologist characteristics associated with higher patient complexity.

Materials and Methods: The average beneficiary Hierarchical Condition Category (HCC) risk scores (Medicare's preferred measure of clinical complexity) were identified for all physicians using 2014 Medicare claims data. HCC scores were compared among physician specialties and further stratified for radiologists based on a range of characteristics. Univariable and multivariable analyses were performed.

Results: Of 549,194 physicians across 54 specialties, the mean HCC risk score was 1.62 ± 0.75 . Of the 54 specialties, interventional radiology ranked 4th (2.60 ± 1.29), nuclear medicine ranked 16th (1.87 ± 0.45), and diagnostic radiology ranked 21st (1.75 ± 0.61). Among 31,175 radiologists, risk scores were higher ($P < 0.001$) for those with teaching (2.03 ± 0.74) vs nonteaching affiliations (1.72 ± 0.61), practice size ≥ 100 (1.94 ± 0.70) vs ≤ 9 (1.59 ± 0.79) members, urban (1.79 ± 0.69) vs rural (1.67 ± 0.59) practices, and subspecialized (1.85 ± 0.81) vs generalized (1.68 ± 0.42) practice patterns. Among noninterventional radiology subspecialties, patient complexity was highest for cardiothoracic (2.09 ± 0.57) and lowest for breast (1.08 ± 0.32) imagers. At multivariable analysis, a teaching affiliation was the strongest independent predictor of patient complexity for both interventional ($\beta = +0.23$, $P = 0.005$) and noninterventional radiologists ($\beta = +0.21$, $P < 0.001$).

Conclusions: Radiologists on average serve more clinically complex Medicare patients than most physicians nationally. However, patient complexity varies considerably among radiologists and is particularly high for those with teaching affiliations and interventional radiologists. With patient complexity increasingly recognized as a central predictor of clinical outcomes and resource utilization, ongoing insights into complexity measures may assist radiologists navigating emerging risk-based payment models.

Key Words: Patient complexity; radiology practice; interventional radiologists; Medicare; health policy.

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INTRODUCTION

Currently, most physician payments are determined on a fee-for-service basis and do not consider either the quality of services rendered or the complexity of patients served. Under the Medicare Access and CHIP Reauthorization Act (MACRA) (1), however, payments will become increasingly value based. Most Medicare participating physicians, whether in a community or academic setting, will soon be paid under the Merit-based Incentive Payment

Service (MIPS), a modified fee-for-service system in which payments will undergo a positive, neutral, or negative adjustment based on a composite performance score determined from a wide range of metrics and compared against national performance levels (2).

To ensure the success of MACRA, the Centers for Medicare & Medicaid Services (CMS) seeks to recognize variation in physicians' practices in determining value-based payment adjustments (2). One important source of such variation is the complexity of physicians' unique patient populations. Physicians caring for sicker patients, as may be anticipated among university and other tertiary care centers, will be challenged in obtaining the same clinical outcomes and resource utilization as those caring for healthier patients. Risk adjustment of performance scores aims to account for such variation (3), and CMS has accordingly adopted risk adjustment as a prominent recurring theme throughout its implementation of MACRA (2), focusing particularly on the Hierarchical Condition Category (HCC) risk adjustment methodology widely applied in other CMS programs. In the Quality performance category of MACRA, for example, all outcome

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measures generally have risk adjustment embedded in the measure calculation. For non-MIPS Quality measures that are submitted through a qualified clinical data registry, the qualified clinical data registry must provide CMS with a plan for risk adjustment of measures, if appropriate (2). Moreover, all measures in the Cost performance category of MACRA specifically entail risk adjustment, which will be performed by CMS (2).

Recent work has indicated that the utilization of medical imaging varies greatly in association with a variety of patient factors (4). As such, radiologists will need to consider the role of risk adjustment in determining how to best navigate new value-based payment systems established by MACRA. Such consideration would benefit from insights into factors that predict higher levels of patient complexity that may be associated with poorer outcomes or higher resource utilization. Identification of such factors would permit radiologists to optimally prepare for and navigate these new systems. Accordingly, we conducted the present study to identify radiologist characteristics associated with Medicare patient complexity.

METHODS

As this investigation did not use private identifiable information, it did not constitute human subject research requiring institutional review board approval.

Data were obtained primarily from the publicly available 2014 Medicare Provider Utilization and Payment Data: Physician and Other Supplier Public Use File, National Provider Identifier Aggregate Report (5). This file contains summary information for providers submitting Part B claims for Medicare fee-for-service beneficiaries. For each included provider, the data set reports the average risk score of the provider's covered beneficiaries based on the HCC model. HCC risk scores were initially developed by CMS for adjusting capitated payments based on expected costs (6) and are now widely used for comparing groups of beneficiaries vs the overall Medicare population. The model's methodology undergoes regular comprehensive evaluation, including recalibration based on regression analyses (6,7). Risk scores take into account beneficiary age, gender, reason for Medicare eligibility, Medicaid dual eligibility status (a proxy for socioeconomic status), and a wide range of high-cost clinically significant comorbidities, so as to prospectively predict beneficiaries' expenditures (6-8). A higher risk score indicates sicker or more complex patients who have overall greater medical risk (8). Prior investigations have shown that the HCC model outperforms the other methods in predicting mortality (9) and is more accurate than other risk adjustment measures for predicting expenditures in certain patient populations (5).

We first identified self-reported primary specialty and average covered beneficiaries' risk scores for all providers in the Physician and Other Supplier Public Use File. We then excluded from this portion of the analysis all nonphysicians as well as all physician specialties with fewer than 100 listed providers

nationwide. The mean and standard deviation of risk scores for each specialty were determined.

Next, we performed more detailed analyses focusing on all 31,175 self-identified radiologists in the Physician and Other Supplier Public Use File. Radiologists were identified as all physicians listing a primary specialty of diagnostic radiology, interventional radiology, or nuclear medicine; listed secondary specialties were not considered. For each radiologist, we then recorded the average beneficiary HCC risk score (as reported directly in the source file), gender, state of practice (which was then classified into broad geographic regions of the United States (10)), and provider zip code (which was then classified as urban or rural (10)). Each radiologist's record was then linked to the CMS Physician Compare database (11) using unique National Provider Identifier assignments. This linking allowed us to also ascertain the following for each radiologist: year of graduation (which was used to estimate each radiologist's years in practice), group practice size, and group practice identifier (which was classified as teaching vs non-teaching (12) based on a previously described methodology (13)). Additionally, we used a recently published radiologist subspecialty classification system (14,15), based on the Neiman Imaging Types of Service (NITOS) system (16), to assign radiologists as generalists or subspecialists based on whether or not at least 50% of their reported claims work relative value units were within a single subspecialty. Specifically, NITOS assigns each individual imaging examination, as indicated by Healthcare Common Procedure Coding System (HCPCS) codes, to an imaging service family as defined by the imaging modality, body region, and potentially a focus area, with these imaging service families then associated with individual radiologist subspecialties. When meeting this 50% threshold in terms of work relative value units, the radiologist's given subspecialty (abdominal imaging, breast imaging, cardiothoracic imaging, musculoskeletal imaging, nuclear medicine, interventional radiology, and neuroradiology) was recorded.

Radiologists' average risk scores were summarized across the previously noted radiologist characteristics, and analysis of variance was used to compare average values. Then, multivariable regression was used to determine those characteristics (each classified in a binary fashion for purposes of regression) serving as independent predictors of risk score; this analysis was performed separately for interventional radiologists and noninterventional radiologists. MedCalc for Windows (MedCalc Software, Ostend, Belgium) was used for the described statistical analyses. Plots were constructed of the distributions of HCC risk scores for all radiologists nationally and separately as stratified by subspecialty (R Foundation for Statistical Computing, Vienna, Austria; <http://www.R-project.org>). A choropleth map (17) was generated to visually depict the state-to-state distribution of radiologists' average HCC risk scores.

RESULTS

Table 1 outlines the average HCC risk score of physicians' covered Medicare fee-for-service beneficiaries, stratified by

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