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Clinical Investigation

Variations in Medicare Reimbursement in Radiation Oncology: An Analysis of the Medicare Provider Utilization and Payment Data Set

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Summary

In April 2014, the Centers for Medicare and Medicaid Services released data for Medicare reimbursement to individual radiation oncologists. We summarized these data and identified factors correlated with higher Medicare reimbursement. There were 4135 radiation oncologists who received a total of $1,499,625,803 (median: $146,453) from Medicare in 2012. Male sex, rural practice location, and billing of technical services were associated with higher total reimbursements.

Purpose: The purposes of this study were to summarize recently published data on Medicare reimbursement to individual radiation oncologists and to identify the causes of variation in Medicare reimbursement in radiation oncology.

Methods and Materials: The Medicare Provider Utilization and Payment Data: Physician and Other Supplier Public Use File (POSPUF), which details nearly all services provided by radiation oncologists in 2012, was used for this study. The data were filtered and analyzed by physician and by billing code. Statistical analysis was performed to identify differences in reimbursements based on sex, rurality, billing of technical services, or location in a certificate of need (CON) state.

Results: There were 4135 radiation oncologists who received a total of $1,499,625,803 in payments from Medicare in 2012. Seventy-five percent of radiation oncologists were male. The median reimbursement was $146,453. The code with the highest total reimbursement was 77418 (radiation treatment delivery intensity modulated radiation therapy [IMRT]). The most commonly billed evaluation and management (E/M) code for new visits was 99205 (49%). The most commonly billed E/M code for established visits was 99213 (54%). Forty percent of providers billed none of their new office visits using 99205 (the highest E/M billing code), whereas 34% of providers billed all of their new office visits using 99205. For the 1510 radiation oncologists (37%) who billed technical services, median Medicare reimbursement was $606,008, compared with $93,921 for all other radiation oncologists ($P<.001$). On multivariate analysis, technical services billing ($P<.001$), male sex ($P<.001$), and rural location ($P=.007$) were predictive of higher Medicare reimbursement.

Conclusions: The billing of technical services, with their high capital and labor overhead requirements, limits any comparison in reimbursement between individual radiation oncologists or between radiation oncologists and other specialists. Male sex and rural practice location are independent predictors of higher total Medicare reimbursements. © 2016 Elsevier Inc. All rights reserved.

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Introduction

In April 2014, the Centers for Medicare and Medicaid Services (CMS) released the Medicare Provider Utilization and Payment Data: Physician and Other Supplier Public Use File (POSPUF), which for the first time detailed Medicare reimbursement to individual physicians. There was extensive media coverage of this release, with particular attention paid to the highest reimbursed providers, many of whom were radiation oncologists (1-3). The release of this data set reflects CMS's larger mandate to increase transparency in health care, with the goal of reducing health care costs while maintaining high-quality care (4). Analyses of the POSPUF have been previously published in other specialties, including otolaryngology, gastroenterology, neurology, and urology (5-8). The purposes of this study are to summarize the POSPUF in radiation oncology, analyze the data, and explain the factors that contribute to variations in Medicare reimbursement.

Methods and Materials

Physician payment data set

The CMS published the POSPUF on April 8, 2014 (9). The methodology used in the POSPUF is described in detail on the CMS website (10). In summary, the POSPUF contains data on nearly all Medicare part B line items in 2012. The data are listed by Healthcare Common Procedure Coding System (HCPCS) codes for each individual provider, identified by their National Provider Identifier (NPI) code. For each NPI, brief demographic information, including the provider's name, credentials, sex, and address, was included. Of note, CMS did not include any line item performed for 10 or fewer Medicare beneficiaries in order to preserve patient privacy. This study was exempt from Institutional Review Board review.

Statistical analysis

We first filtered the complete POSPUF for line items from radiation oncologists (provider_type = "Radiation Oncology"). Services not billed by individual radiation oncologists but by radiation therapy centers (provider_type = "Radiation Therapy") were excluded. Reimbursement to radiation therapy centers was less than 5% of reimbursement to individual radiation oncologists. For each provider, there are individual line items for each HCPCS code performed by that physician. Using this information, total Medicare reimbursement for each billing code was computed. The POSPUF also contains a separate aggregate table that includes the number of unique beneficiaries, number of services, and total Medicare reimbursement for each physician. Because some radiation oncologists bill

Table 1 Top 25 billing codes in radiation oncology by total Medicare reimbursement

HCPCS code	Description	Number of services	Total Medicare payment
77418	Radiation Tx delivery IMRT	1,216,812	$458,405,233
77427	Radiation Tx management × 5	1,111,670	$156,445,631
77014	CT scan for therapy guide	1,187,293	$93,298,267
77413	Radiation treatment delivery	469,942	$88,245,678
77301	Radiation therapy dose plan IMRT	85,382	$76,891,289
77414	Radiation treatment delivery	332,139	$68,400,852
77300	Radiation therapy dose plan	1,671,824	$60,441,080
77290	Set radiation therapy field	323,540	$59,927,232
77334	Radiation treatment aid(s)	850,266	$57,433,413
77421	Stereoscopic x-ray guidance	1,280,035	$50,049,719
77263	Radiation therapy planning	256,727	$32,038,320
77295	Set radiation therapy field	130,849	$30,921,424
77338	Design mlc device for IMRT	104,321	$28,430,333
77280	Set radiation therapy field	266,676	$19,513,065
77336	Radiation physics consult	445,798	$16,352,576
99205	Office/outpatient visit new	107,035	$14,937,562
99213	Office/outpatient visit est	295,069	$12,465,250
78815	PET image w/CT skull-thigh	16,517	$11,852,127
77373	SBRT delivery	8025	$10,204,534
77470	Special radiation treatment	101,072	$10,081,244
99204	Office/outpatient visit new	88,860	$9,832,514
77522	Proton trmt simple w/comp	12,416	$8,897,438
77416	Radiation treatment delivery	39,821	$8,543,026
99214	Office/outpatient visit est	132,040	$8,491,743
0182T	HDR elect brachytherapy	4402	$7,277,927

Abbreviations: CT = computed tomography; est = established; HCPCS = Healthcare Common Procedure Coding System; HDR elect = High Dose Rate elective; IMRT = intensity modulated radiation therapy; mlc = multileaf collimator; PET = positron emission tomography; SBRT = stereotactic body radiation therapy; trmt = treatment; Tx = treatment.

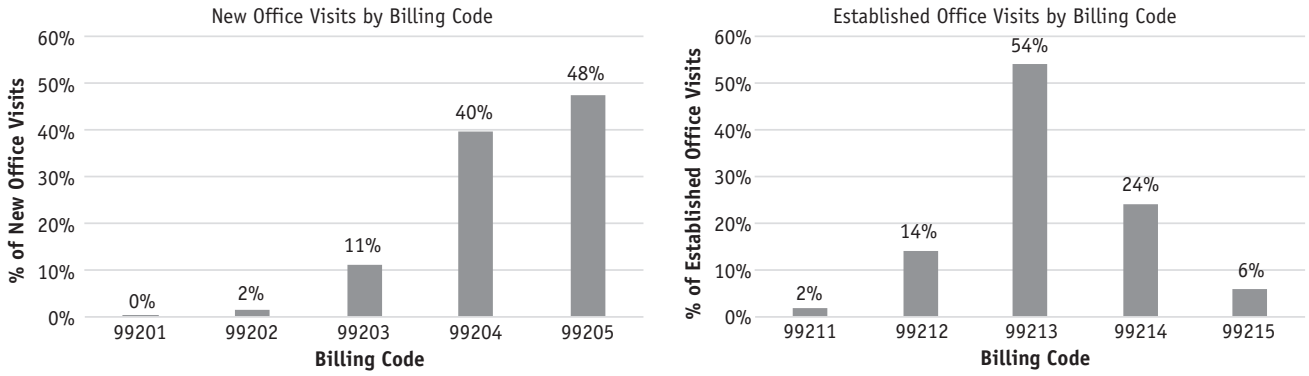

Fig. 1. Distribution of new and established office visits by billing codes 99201-99205, the new patient office visit billing codes, with 99205 having the highest reimbursement. Codes 99211 to 99215 are established patient office visit billing codes, with 99215 having the highest reimbursement.

Medicare for technical fees while others do not, we categorized a provider as billing for technical fees if they were reimbursed for the commonly billed technical codes 77413 and 77414 (radiation treatment delivery) or 77418 (radiation Tx delivery intensity modulated radiation therapy [IMRT]). We also calculated total reimbursement for the office evaluation and management (E/M) professional codes (99201-99205 for new visits or 99211-99215 for established visits).

To assess geographic variation in Medicare reimbursements, we determined the "rurality," or place along the rural-urban continuum, of each radiation oncologist's practice by converting his or her listed ZIP code to the corresponding Federal Information Processing Standards (FIPS) county code (11). We then used the 2013 Rural-Urban Continuum Codes published by the US Department of Agriculture Economic Research Service to determine the provider's rurality (12). Because of the limited number of radiation oncologists working in nonmetropolitan areas, these radiation oncologists were all grouped into a single rurality group (nonmetropolitan). For our study, radiation oncologists were divided into 1 of 4 groups: large metropolitan areas with population greater than 1 million; mid-sized metropolitan areas with population between 250,000 and 1 million; small metropolitan areas with population less than 250,000; and nonmetropolitan areas.

For analysis, physicians were divided by sex, rurality, billing of technical services, and location in a certificate of need (CON) state. Mann-Whitney U tests were used to determine any correlations between dichotomous variables and Medicare reimbursements. The Jonckheere-Terpstra trend test, a variant of the Kruskal-Wallis test for ordered categorical variables, was used to determine the association between rurality and Medicare reimbursements. For cross-tab data, we used the Pearson χ^2 test for binary variables (sex) and the Mantel-Haenszel (linear-by-linear) χ^2 test for ordered categorical variables (rurality). Multivariate analysis was performed using linear regression techniques. Statistical analysis was performed in Microsoft Excel 2013 (Microsoft, Redmond, WA) and SPSS version 19 (IBM, Armonk, NY). All statistical tests were deemed statistically significant if the P value was $<.05$.

Results

There were 4135 radiation oncologists who received payments from Medicare in 2012 totaling $1,499,625,803.

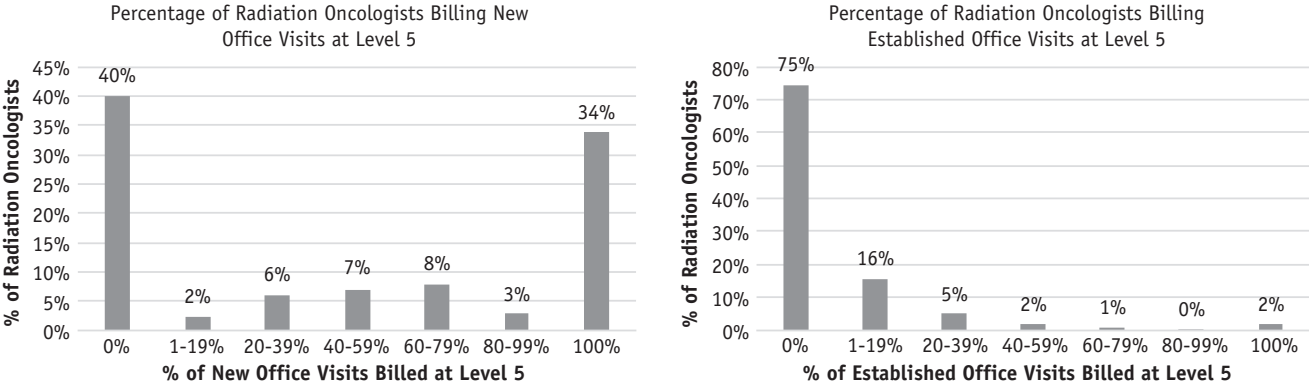

Fig. 2. Distribution of radiation oncologists billing level-5 E/M office visits. Code 99205 is a level-5 billing code for new patient office visits. 99215 is level-5 billing code for established patient office visits.

Table 2 Medicare reimbursement by sex

Parameter	Total	Male	Female	*P*
Number of providers	4135	3096	1039	
Patients treated	179	192	146	<.001
Services provided	2007	2275	1466	<.001
Total reimbursement	$146,453	$161,943	$106,936	<.001
E/M reimbursement	$10,345	$11,239	$8160	<.001
Providers billing technical fees (%)	1510 (37%)	1182 (38%)	328 (32%)	.002

Abbreviation: E/M = evaluation and management.
Technical fees are defined as billing codes 77413, 77414, or 77418.

Seventy-five percent of listed radiation oncologists were male. The median reimbursement was $146,453 (interquartile range: $69,787-$423,356). The median number of unique Medicare beneficiaries treated was 179, and the median number of services provided was 2007. The median number of office E/M visits was 150, with reimbursement of $10,345.

A total of 616 distinct HCPCS codes were reimbursed to radiation oncologists. The most frequently billed code was 77300 (radiation therapy dose plan), followed by 77421 (stereoscopic x-ray guidance), 77418 (radiation Tx delivery IMRT), 77014 (computed tomography [CT] scan for therapy guide), and 77427 (radiation Tx management × 5). Codes with the highest total reimbursements were 77418 (radiation Tx delivery IMRT), followed by 77427 (radiation Tx management × 5), 77014 (CT scan for therapy guide), 77413 (radiation treatment delivery), and 77301 (radiation therapy dose plan IMRT). The top 25 billing codes by total Medicare reimbursement representing 93% of all Medicare reimbursement in radiation oncology are included in Table 1.

Medicare paid for 224,959 new office visits (HCPCS codes 99201-99205) and 546,587 established office visits (HCPCS codes 99211-99215) to radiation oncologists. The frequency distributions of E/M codes are listed in Figure 1. The most commonly billed E/M code for a new visit was 99205 (49%), followed by 99204 (40%). The most commonly billed E/M code for an established visit was 99213 (54%), followed by 99214 (24%). To further analyze variability in billing patterns, we determined the frequency at which individual radiation oncologists billed office visits at level 5, the highest E/M level (Fig. 2). For new office visits, 40% of providers billed none of their visits at level 5, whereas 34% of providers billed all of their new office visits at level 5. For established office visits, 75% of radiation oncologists billed none of their visits at level 5, whereas 2% of providers billed all of their established visits at level 5.

Total Medicare reimbursement is sharply split between radiation oncologists who bill technical fees and those who only bill professional services, with the technical fees billed by their hospital or facility. For the 1510 (37%) radiation oncologists who billed technical services, median Medicare reimbursement was $606,008, compared with $93,921 for all other radiation oncologists ($P<.001$).

Median Medicare reimbursement to male radiation oncologists was $161,943, versus $106,936 for female radiation oncologists ($P<.001$) (Table 2). Female radiation oncologists also treated fewer patients (median: 146 vs 192, respectively; $P<.001$) and had lower total payments for E/M office visits ($8160 vs $11,239, respectively; $P<.001$). Male radiation oncologists (38%) were also more likely than female radiation oncologists (32%) to bill technical services ($P=.002$).

Reimbursement data by geographic location are summarized in Table 3. Radiation oncologists in large metropolitan areas (metropolitan areas of greater than 1 million people) had lower median reimbursements ($130,412) than

Table 3 Medicare reimbursement by rurality

Parameter	Large metro area	Mid-sized metro area	Small metro area	Non-metropolitan area	*P*
Number of providers	2462	964	445	264	
Patients treated (median)	162	215	207	185.5	<.001
Services provided (median)	1765.5	2334	2653	2492	<.001
Total reimbursement (median)	$130,412	$168,115	$180,236	$178,149	<.001
E/M reimbursement (median)	$9120	$11,749	$13,079	$14,292	<.001
Average reimbursement for 77418	$391	$367	$353	$343	<.001
Providers billing technical fees (%)	869 (35%)	388 (40%)	151 (34%)	102 (39%)	.291

Abbreviation: E/M = evaluation and management.
Technical fees are defined as billing codes 77413, 77414, or 77418. Large metropolitan is defined as a metropolitan area with population greater than 1 million; mid-sized metropolitan is an area with population between 250,000 and 1 million people; small metropolitan area is an area with population less than 250,000 people; and non-metropolitan is an area outside of a metropolitan area, regardless of population.

their counterparts in less urban settings ($168,115 in mid-size metropolitan areas of 250,000 to 1 million people, $180,236 in small metropolitan areas less than 250,000 people, $178,149 for nonmetropolitan areas; $P<.001$). Providers in the largest metropolitan areas saw the fewest patients (median: 162 unique beneficiaries), whereas providers in mid-sized metropolitan areas saw the most (median: 215 unique beneficiaries). Higher office E/M ($P<.001$) reimbursements were also correlated with more rural practice settings. However, there was no trend toward more frequent billing of technical fees among radiation oncologists in more rural practices ($P=.291$). In addition, consistent with Medicare reimbursement differences based on cost of living, the average reimbursement for 77418 (radiation Tx delivery IMRT) declined with increased rurality ($P<.001$).

Provider location in a CON state was not predictive of total Medicare reimbursement on univariate analysis ($P=.837$). Multivariate analysis found billing of technical services ($P<.001$), male sex ($P<.001$), and rural location ($P=.007$) to be predictive of higher Medicare reimbursement.

Discussion

The high Medicare reimbursement to radiation oncologists was highlighted in numerous news articles covering the release of the POSPUF (2, 3). Our analysis shows the inherent limitations of such comparisons. Most Medicare "reimbursement" to radiation oncologists was for technical services, which have significantly higher overhead costs than professional services. When only professional fees were included, the average Medicare reimbursement to radiation oncologists is comparable with that of other specialties.

Furthermore, as noted by others (7), the published Medicare reimbursement in the POSPUF should not be equated with physician income. There are significant capital (eg, treatment machines, treatment facilities) and labor (eg, radiation therapists, physicists, dosimetrists) requirements to bill technical fees, so only a fraction of the excess Medicare reimbursement to physicians billing technical services is additional income. Conversely, even radiation oncologists who do not bill technical fees are indirectly paid for the technical fees reimbursed to their employer. This is suggested from our finding that the average reimbursement for physicians who do not bill technical fees is $93,921 according to the POSPUF, significantly less than typical radiation oncologist salaries.

The POSPUF has been analyzed in several other specialties. Skolarus et al (8) analyzed the POSPUF in neurology, who found that the billing of technical services was associated with higher total reimbursement, similar to our conclusions in radiation oncology. The highest reimbursed neurology procedures were electromyograms (EMG) and electroencephalograms (EEG), both of which require upfront capital outlays. In urology, Ko et al (7) found significant variation in the utilization of certain HCPCS codes between the highest and lowest reimbursed urologists (7). Although we did not perform a similar analysis of HCPCS codes in radiation oncology, we did highlight the significant variation in E/M billing among radiation oncologists.

Our analysis of POSPUF data identified significant sex differences in median Medicare reimbursements. However, we caution against interpreting this sex difference in Medicare reimbursements as further evidence of a sex pay gap, which has previously been documented in published reports (13-15). POSPUF represents Medicare reimbursements, not take-home pay. Medicare does not reimburse male and female physicians at different rates, and therefore the differences in reimbursement can be explained by differences in the number and mixture of services provided. Indeed, our data set showed that female radiation oncologists, on average, provided fewer services, treated fewer patients, and had lower office E/M reimbursement than their male counterparts. In addition, a higher percentage of male radiation oncologists billed technical fees, which we found to be a major determinant of total Medicare reimbursement. Given that female radiation oncologists are younger and more likely to work part-time (16), the difference in Medicare reimbursements seen in our analysis should be expected.

We describe higher median Medicare reimbursement with increasing rurality of practice location. Given that Medicare pays lower rates to rural physicians because of differences in cost of living, this difference can be attributed to rural physicians seeing more patients and performing more services, which is confirmed in our analysis.

There are several limitations to our study. First, as explained above, Medicare reimbursement should not be confused with physician income, as there are high capital and labor requirements in radiation oncology, particularly with technical services. This limits any direct comparison between individual radiation oncologists or between radiation oncologists and other specialists. Second, we used only 3 billing codes as proxies for technical fees, although there are many other technical fees, including those in proton therapy, radiosurgery, and brachytherapy. Third, these data represent only claims from Medicare beneficiaries, which represent a fraction of the total population with cancer. Finally, all totals calculated from the POSPUF are lower than the actual totals, as CMS excluded all line items with 10 or fewer beneficiaries.

Conclusions

In conclusion, this analysis of the POSPUF in radiation oncology highlighted the significant limitations in comparing reimbursements between individual radiation oncologists and between radiation oncologists and other physicians, given the high overhead costs of technical services in radiation oncology. However, there exist sex and

rurality differences in reimbursement, independent of the billing of technical services, which are explained by differences in patient volumes. There is significant variability in the billing practices of radiation oncologists for office E/M visits.

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