Patterns of Costs and Spending Among Orthopedic Surgeons Across the United States: A National Survey

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Abstract

Due to rising medical costs, the purpose of this study was to investigate the spending patterns of orthopedic surgeons across the United States and the financial implications of such behavior.

Overall, 2,000 randomly chosen orthopedic surgeons from the American Academy of Orthopedic Surgeons (AAOS) were invited to answer web-based surveys on their utilization of healthcare resources; 1,214 (61%) completed the survey. There was a significant difference ($P < .001$) in monthly expenditure based on 8 domains of orthopedic care for the average orthopedist: x-ray costs were $7,536, computed tomography costs were $2,340, magnetic resonance imaging costs were $14,975, ultrasound costs were $686, laboratory test costs were $969, specialty referral costs were $1,389, biopsy costs were $1,314, and hospital admission costs were $6,808. Significant differences in monthly expenditure existed based on orthopedist practice setting ($P < .001$), subspecialty ($P < .001$), gender ($P < .001$), and age ($P < .001$). Demographics with the highest monthly spending included orthopedic private group setting ($36,278), orthopedic oncology subspecialty ($41,795), male gender ($33,843), and age 50 to 59 ($35,559). The average monthly expenditure for orthopedists nationally was calculated to be $33,436 per physician.

Given there are approximately 20,400 practicing orthopedists, the annual United States expenditure in orthopedic surgery was calculated to be $8.2 billion. Orthopedic spending is a significant component of national healthcare expenditure.

In 2010, national health care expenditures totaled $2.6 trillion and represented 17.9% of the United States gross domestic product (GDP).[1,2] Healthcare spending has outpaced United States' economy growth by a factor of 2.5 and is expected to reach 25% of GDP by 2025.[3,4] Furthermore, collective surgical expenditures are projected to increase to $912 billion or 7.3% of the United States GDP by 2025.[5] Although governmental and private research efforts have attempted to identify the major drivers of increasing healthcare spending, one potential avenue in lowering healthcare expenditure may be curtailing physician and clinical service costs in surgical specialties.[6-8] Physician and clinical service spending comprised $515.5 billion in 2010, and represented 51% of all healthcare costs when combined with hospital service care spending.[1,9]

Major components of physician and clinical service spending in surgical areas include costs for imaging, laboratory tests, and specialty referrals. The use of x-ray radiographs, computed tomography (CT) scans, and magnetic resonance imaging (MRI) studies has steadily increased over the past 3 decades.[10,11] Concomitantly, imaging costs have increased over 100% during the same time period.[12,13] Physician specialty referrals have also risen in absolute numbers 151% from 1999 to 2009, and serve as a major contributor to healthcare expenditures.[14] A significant factor in hospital service care costs resulting from physician decision-making includes expenditures for hospital admissions. From 2003 to 2008, hospital costs per day increased at rates of 4% and 6% respectively for Medicare and non-Medicare patients.[15] The total number of hospital admissions also has increased over the past decade, therefore further contributing to increasing healthcare costs.[16,17]

Of the estimated 954,200 physicians in the US, orthopedic surgeons comprise 24,800 or nearly 2.6% of all physicians.[18,19] However, musculoskeletal diseases are the leading cause of disability in the US with treatment for such diseases accounting for nearly 5% of the national GDP.[20,21] Despite the prevalence of orthopedic problems in the US, a void in the literature exists detailing the healthcare expenditures associated with orthopedic surgeons. In 2011, Laugesen and Glied argued that higher healthcare expenditures are allocated to US orthopedic surgeons, compared with other countries for hip replacements, but their study did not investigate the components of physician and clinical service costs associated with orthopedic surgeons.[22] A 2012 report by the US Census Bureau demonstrated increasing trends in physician and clinical service spending from $5.5 billion in

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1960 to over $500 billion in 2009, but the report failed to provide results specifically for orthopedic surgery.[17] A 2008 report by the Massachusetts Medical Society surveyed physicians in a variety of subspecialties including orthopedics to assess total imaging, laboratory tests, and referrals costs in a defensive medicine context, but the investigation was limited to state-level analysis.[23]

Studies have researched aggregate physician healthcare expenditure on a national level across all primary care and specialty fields.[24] However, no one has yet investigated the national expenditure in the field of orthopedics across all subspecialties, practice settings, and practice locations. Given the pervasiveness of musculoskeletal diseases in the US, it is important to investigate the total expenditure by the orthopedic community to identify the areas of highest orthopedic spending. In light of pending Medicare reimbursement payment reductions by the Independent Payment Advisory Board (IPAB), identifying such areas may help orthopedists become more mindful in controlling costs.[25]

In this paper, we report the spending results from a national survey of orthopedic surgeons across the US based on 2011 Medicare cost data. Through collected demographics, we identify the areas and groups of highest spending amongst the orthopedic community and estimate the contribution of the field of orthopedic surgery to the national healthcare burden.

Materials and Methods

Study Population

After obtaining approval from our institutional review board, in September of 2010 we randomly selected 2,000 orthopedic surgeons registered to the American Academy of Orthopaedic Surgeons (AAOS) database to be invited for participation in our study. Selected surgeons were emailed an anonymous, Web-based survey administered through the AAOS Healthcare Statistics and Research Surveys Unit. To ensure that only AAOS members had access to the survey, participants were provided with unique survey IDs in the email invitations. Instructions on the survey noted that the AAOS was investigating the frequency in which orthopedists order different tests, procedures, admissions, and consultations in a typical month to develop an understanding of costs in the US healthcare system. Survey administration lasted 3 months with data collection closing in December of 2010. Overall, 1,214 orthopedists (61%) had successfully completed and submitted the survey during this time period. No financial or other incentives were provided for participation in the study. Responses were on volunteer basis only. Non-respondents were emailed reminders every 2 weeks during the data collection period with a link to the original survey.

Data Collection Instrument

The survey consisted of 7-items collecting respondent information on basic demographics such as age, gender, subspecialty, practice setting, and practice location. The survey also asked respondents to estimate the total number of tests or procedures ordered in a typical month in 8 areas of orthopedic care: plain film x-rays, CT scans, MRI studies, ultrasound studies, specialty referrals or consultations, laboratory tests, biopsies/

Table I. Demographic Information for Survey Respondents

Age (years)	n	%
30-39	97	8.3
40-49	398	34.2
50-59	433	37.2
60-69	211	18.1
70-70	26	2.2
Gender		
Female	56	4.9
Male	1086	95.1
Practice setting		
Private practice ortho group	575	49.4
Academic practice	177	15.2
Private practice solo	152	13.1
Private practice multispecialty group	113	9.7
Clinical hospital	73	6.3
Other group	27	2.3
PPO/HMO	23	1.9
Military practice	12	1.0
Non-military or government practice	12	1.0
Subspecialty		
Adult knee	460	38.8
Sports medicine	421	35.5
Arthroscopy	411	34.7
Total joint	395	33.3
Adult hip	390	32.9
Shoulder and elbow	309	26.1
Trauma	224	18.9
Hand	218	18.4
Foot and ankle	150	12.7
Adult spine	119	10.0
Pediatric orthopaedics	93	7.8
Other	60	5.1
Disability/legal orthopaedics	58	4.9
Pediatric spine	53	4.5
Nonoperative practice	52	4.4
Ortho-oncology	27	2.3
Rehabilitation/prosthetics/orthotics	13	1.1
Practice location		
US Census region 2 (“South”)	378	32.4
US Census region 4 (“West”)	292	25.1
US Census region 3 (“Midwest”)	268	23.0
US Census region 1 (“Northeast”)	227	19.5

Basic demographic information (age, gender, practice setting, subspecialty, and practice location) provided by survey respondents.

Table II. **Average Costs in a Typical Month per Respondent Based on Procedures Ordered in Eight Areas of Orthopedic Care**

	A. Mean number of procedures ordered per month	B. Average cost per procedure	C. Average monthly cost (AxB)
Plain film x-rays	192.99	$39.05	$7,536.26
CT scans	6.98	$335.13	$2,339.21
MRI studies	28.31	$528.98	$14,975.42
Ultrasound studies	4.96	$138.26	$685.77
Specialty referrals	12.73	$109.13	$1,389.22
Laboratory tests	54.48	$17.78	$968.65
Biopsies/aspirations	9.81	$133.99	$1,314.44
Hospital admissions	17.87	$381.00	$6,808.47
Total (weighted)	—	—	$33,436.20

The average number of procedures ordered in a typical month by orthopedists and the average cost per procedure in each of the 8 areas of orthpedic care (ie. x-rays, CT scans, MRI studies, etc) are provided in columns A and B. Column C denotes the average weighted monthly cost associated with each of the 8 areas of orthopedic care based on the information in columns A and B.

aspirations, and hospital admissions. The survey used short, straightforward questions with checkbox and dropdown items to reduce error and minimize survey-taking time. Questions were arranged in a logical order to improve survey flow.

Cost-Analysis

Costs for the 8 areas assessed in the study were calculated using Current Procedural Terminology (CPT) code level at the 2011 level from the American Medical Association "relative value search" database. CPT code levels applicable to orthopedic care in the 8 areas studied were assessed by independent inclusion criteria from 3 attending orthopedic surgeons. CPT codes not identified by independent review from these 3 practicing orthopedic surgeons were excluded from the study. Flat dollar values were applied to each CPT code based on 2011 Centers for Medicare and Medicaid Services relative value units. Average per unit procedural costs for each of the 8 areas in the study were calculated by taking the average of all CPT code flat dollar values in a given area. These average per unit costs were then used in conjunction with survey respondents' answers to determine the average monthly and yearly expenditures per survey respondent. Extrapolations and calculations were performed using standard software, with frequency, mean, median, standard deviation, minimum value, maximum value, and confidence intervals provided for each survey element. Non-parametric analysis of variance tests were conducted to assess significant differences in the 8 areas studied and between different demographic groups.

Results

Respondent Demographics

Overall, 2,000 orthopedic surgeons in the AAOS registry were randomly selected for participation in the study, with 1,214 participants (61%) successfully completing and submitting the survey during the 3-month data collection period. **Table I** lists basic demographic information for respondents. The average respondent age was 52 years, with most participants (71.3%) between 40 to 59 years of age. The majority of respondents (93.2%) were men. Out of the 17 possible subspecialties available in the survey, respondents indicated an average of 3 subspecialties. As shown in **Table I**, adult hip was the most represented subspecialty (38.8%) and rehabilitation, prosthetics, and orthotics were the least represented (1.1%). Out of 9 possible practice setting choices, private practice orthopedics group was the most popular practice setting (48.6%) and military practice was the least popular (1.1%). Respondents represented all 50 states and the District of Colombia, with US Census Region 2 (ie, Southern states such as Florida, Georgia, Tennessee, etc.) the most represented (32.4%) and US Census Region 1 (ie, Northeastern states such as Maine, New York, Pennsylvania, etc.) the least represented (19.5%).

Estimated Monthly and Annual Expenditure

Based on self-reported participant data, the procedure most often ordered per month by the average respondent was plain-film radiographs and the least performed procedures were ultrasound studies (**Table II**). However, based on calculated per unit procedural costs, MRI expenditure was the greatest cost driver for the average respondent at a mean of $14,975 per month, representing 41% of all monthly expenditures (**Figure 1**). A significant difference ($P < .001$) existed in spending amongst the 8 different areas of orthopedic care investigated for the average respondent. Using the costs associated with the 8 areas of orthopedic care assessed in the study, the total estimated expenditure per respondent was calculated to be $33,436 per month, or $401,234 per year based on survey responses. Given that there are approximately 20,400 prac-

Table III. Average Monthly Expenditure per Orthopedist Based on Subspecialty

Specialty Indicated	Average Monthly Expenditure	Number Surveyed
Ortho/oncology	$41,795.32	27
Adult spine	$40,514.43	119
Adult knee	$37,633.10	460
Total joint	$37,472.79	395
Adult hip	$37,362.25	390
Arthroscopy	$36,049.75	411
Sport medicine	$35,948.40	421
Shoulder & elbow	$35,236.12	309
Trauma	$35,041.30	224
Foot & ankle	$31,370.26	150
Pediatric spine	$31,070.81	53
Other	$28,922.85	60
Pediatric orthopedics	$28,173.08	93
Hand	$27,212.01	218
Disability/legal/orthopedics	$27,003.06	58
Rehab/prosthetic/orthotics	$25,068.47	13
Non-operative practice	$21,486.77	52

The average monthly spending patterns for orthopedists based on sub-specialty.

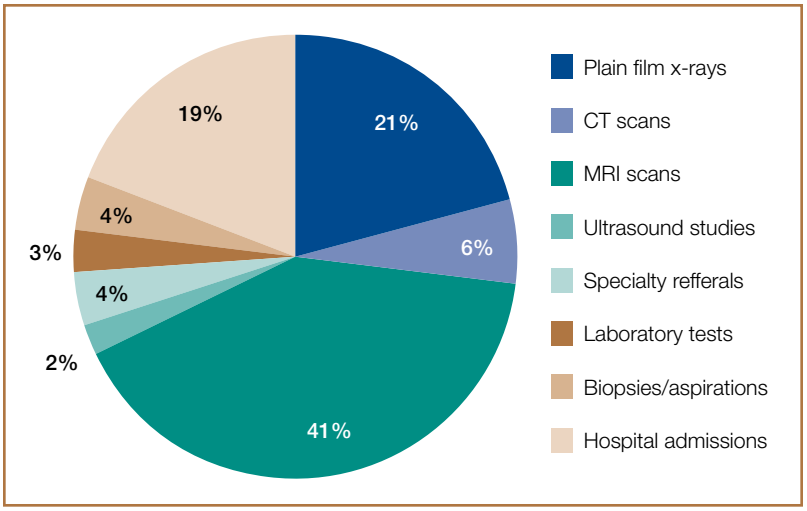

Figure 1. The average spending patterns for survey respondents in a typical month based on the 8 areas of orthopedic care assessed in the study (ie, x-rays, CT scans, MRI studies, etc). For example, 41% of average monthly costs for survey respondents were allocated towards MRI studies.

ticing orthopedic surgeons in the US, annual healthcare expenditure based on procedures ordered by orthopedists was extrapolated to be $8.2 billion a year.

Demographic Trends

A significant difference ($P < .001$) existed in orthopedist procedural expenditure based on age (**Figure 2**). Respondents were stratified in 10-year age intervals based on conventions used in other healthcare cost studies. Frequency of respondents based on age group and average orthopedist monthly expenditure per age group were both bell-shape distributions. The peak frequency of respondents based on age group was 50 to 59 years. This age group also had the highest average monthly expenditure at $35,559. Statistically significant differences amongst age groups were assessed using nonparametric analysis of variance.

Figure 3 illustrates average monthly expenditure for males and females. An overwhelming majority of respondents were male (93.2%), with 2.1% of respondents failing to note gender. Using a nonparametric t-test, a significant difference was found with gender ($P < .001$): male orthopedic surgeons spent more than $11,000 per month on average, compared with female orthopedic surgeons.

Respondents on average marked 3 subspecialties corresponding to their individual practice, with the frequency of marked subspecialties demonstrating positive or left-handed skewness since over half of all respondents (50.9%) marked just 1 or 2 subspecialties. Orthopedic oncology specialist represented the greatest average monthly spending per physician at $41,795, with orthopedists in nonoperative practices spending the least per month at $21,487. Among surgical subspecialties, orthopedic hand specialist had the lowest average monthly expenditure at $27,212. A significant difference ($P < .001$) existed among monthly expenditure based on subspecialty using nonparametric analysis of variance (**Table III**).

Figure 4 shows the monthly expenditure for the average orthopedist in a given practice setting. Respondents were instructed to mark only 1 practice setting, with 6 respondents (0.5%) failing to provide a response. Orthopedists in private practice groups averaged the greatest monthly costs at $36,279, compared with orthopedists who were part of PPO/HMO networks averaging the lowest costs at $21,258. Private practice group respondents also represented the most popular setting represented

in the survey (48.6%). There was a significant difference ($P < .001$) in monthly expenditure based on practice setting using nonparametric analysis of variance.

Participants were asked to identify their primary practice location based on US state. Six respondents (0.5%) did not answer this question. California was the most represented state with 131 respondents (10.8%), and Delaware, Alaska, North Dakota, South Dakota, and Wyoming were the least represented states with just 1 or 2 respondents each (0.1% to 0.2%). **Figure 5** illustrates average monthly expenditure per orthopedist based on US Census Region, with Region I ("Northeast" US) having the highest monthly spending at $37,414, and Region IV ("West") having the lowest monthly spending at $27,757.

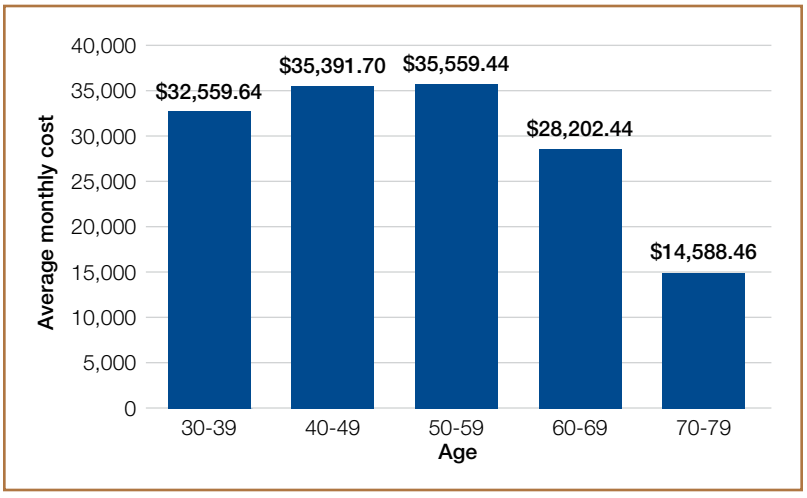

Figure 2. The average monthly spending patterns for orthopedists based on age stratified in 10-year age intervals.

Discussion

Our results estimate that the average expenditure per survey respondent was approximately $33,500 in a typical month or $400,000 per year, resulting in a contribution of $8.2 billion to total national healthcare expenditures from the orthopedic community for imaging, laboratory tests, referrals, and hospital admissions. Demographics influencing highest spending behavior included: age 50 to 59 years, male gender, orthopedic oncology subspecialty, orthopedic private group practice setting, and geographical practice location situated in the Northeast US. Trends in our sample demographics followed similar trends in the national orthopedist population outlined in the 2011 AAOS Census, with percentage of men, practice setting distribution, subspecialty distribution, and practice location all corresponding well with national census trends.[19]

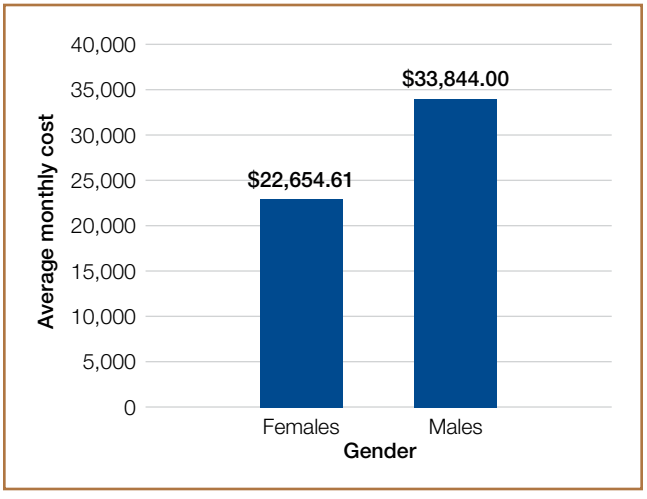

Figure 3. The average monthly spending patterns for orthopedists based on gender.

Given that national physician and clinical services spending totaled $515 billion in 2010, which included all services and procedures by MD and DO trained physicians in hospitals and outpatient centers, our results indicate that orthopedic expenditure for the 8 areas assessed in the study represented 1.6% of all physician and clinical services spending in 2010.[1] A 2008 survey by the Massachusetts Medical Society at the state level also yielded similar results to those in our study,[23] with the average orthopedist respondent in Massachusetts spending approximately $30,000, compared with $33,500 in our study each month on x-rays, CT scans, MRI studies, ultrasound studies, specialty referrals, laboratory tests, and hospital admissions. The Massachusetts survey did not query respondents on the number of biopsies/aspirations ordered in a typical month, which accounted for nearly $1,300 in monthly expenditures for the average respondent in our study. Furthermore, compared with respondents in the Massachusetts survey, orthopedists across the US in our survey ordered 50% more plain film x-rays, 50% more hospital admissions, and nearly 100% more laboratory tests in a given month, which also accounted for the difference in average monthly expenditure between these 2 studies. Nevertheless, based on the similarities between these state-based and national surveys, our results can be extrapolated to the national orthopedic community for an overall estimate of imaging, laboratory tests, referrals, and hospital admission costs.

Safely assuming that orthopedists who perform more monthly procedures also tend to have higher monthly expenditures, demographic expenditure results in our study overall correspond well with published procedural trends in the 2010 AAOS National Census.[19] According to the Census, orthopedists in private practice groups had the highest mean procedure rate per month at 35.71, and orthopedists in PPO/HMO settings had one of the lowest mean procedure rates at 25.64 per month, matching well with our findings that private practice group orthopedists had the greatest monthly expenditure, and PPO/HMO orthopedists had the lowest monthly expenditure. In terms of age, the Census found that orthopedists aged 40 to 49 averaged 35.33 procedures

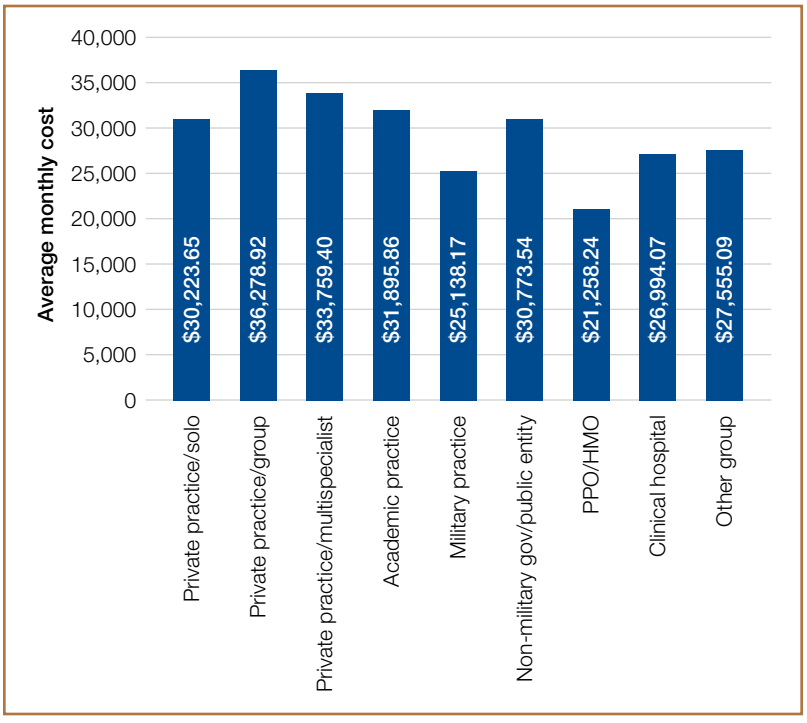

Figure 4. The average monthly spending patterns for orthopedists based on practice setting.

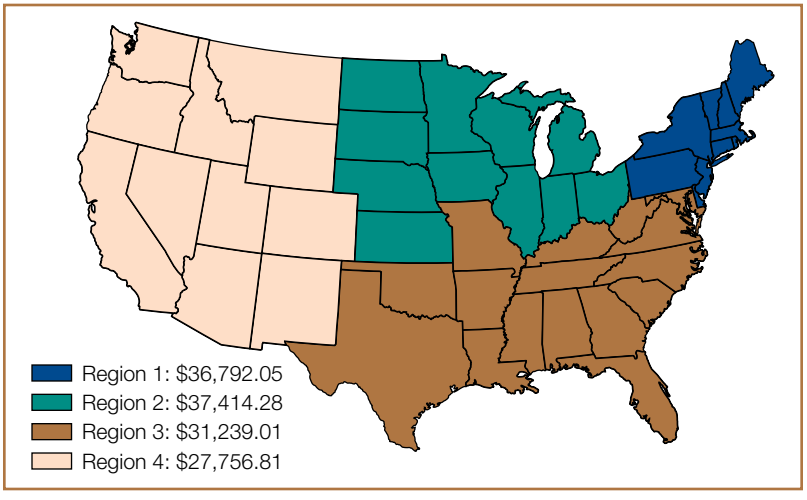

Figure 5. The average monthly spending patterns for orthopedists based on the 4 US Census regions.

a month, compared with 34.38 for orthopedists aged 50 to 59, which similarly correlated with our 2 highest age group expenditures. A discrepancy did exist in terms of average monthly procedures and expenditure based on US Census Region. We found that Region I ("Northeast) had the highest monthly spending and Region IV ("West") had the lowest spending. However, based on calculated procedural data present in the Census report, Region III ("Midwest") had the highest procedural rate and Region I had the lowest procedural rate.

Furthermore, given that the majority of physicians are paid through Medicare and private insurance fee-for-service schedules based on the numbers of procedures conducted and tests ordered, our expenditure data also follows national compensation trends in this respect for orthopedists. According to a 2011 Medscape survey fielded to over 15,700 US physicians, female orthopedists earn less than their male counterparts.[26] This trend is similarly reflected in our data with female orthopedists spending less per month than male orthopedists. Orthopedists in private practice groups also had the highest compensation rates, similar to our study in that private practice orthopedists spent the most. Finally, orthopedists with practice locations in the Western US had the lowest compensation rates, which is similarly reflected in our study in terms of monthly expenditure.

Recent arguments in controlling healthcare expenditure have centered on reducing physician reimbursement fees for tests and procedures ordered. The Independent Payment Advisory Board specifically suggests cutting Medicare payouts by nearly 30%. Because our results were based on 2011 public reimbursement values for all included CPT codes in the study, a 30% cut would reduce our calculated value of $8.2 billion in expenditure by orthopedists on imaging, laboratory tests, referrals, and hospital admissions to $5.74 billion per year. These cuts would only represent a 0.5% reduction in total physician and clinical services spending. Other mechanisms therefore are needed to truly curtail healthcare expenditure.

Our study is limited due to the recall nature for orthopedists to note the average number of tests or procedures ordered. Furthermore, concern over perceptions of total expenditure may have biased respondents to report lower numbers of tests in each of the 8 areas assessed. Because the study used self-reported data, blanks or missing values were counted as such and not as "zero" values, thereby potentially skewing the intended responses by participants.

For cost calculations, we used conservative measures by calculating average CPT cost information from 2011 Centers of Medicare and Medicaid values. Notably, averaging all values for a given area of study (ie, MRI scans, for example) would tend to underestimate the actual costs associated with that area. Furthermore, we only used public cost data instead of private health insurance reimbursement schedules, which are typically higher for a given test or procedure. Any CPT code that was not identified through independent reviews by attending orthopedic surgeons were not included in the study, which would further underestimate

the true expenditures of orthopedists if excluded CPT codes are used by respondents. For hospital admission calculations, only a single CPT code was used representing admission for observation between 8 and 24 hours. In extrapolating calculated cost information for survey respondents to the national orthopedic community, our sample population only represented 6% of all practicing orthopedic surgeons according to a recent estimate,[19] so some caution must be used despite sample characteristics matching well with national orthopedist characteristics. Finally, no sensitivity analysis was conducted in the survey which would have required a different study design than the one administered in this investigation.

While our study investigated average expenditure for orthopedic surgeons across the US, it is important to place our results in context with expenditures from other surgical subspecialties. Although the Massachusetts Medical Society in 2008 surveyed a variety of specialties including neurological surgery, no study has yet truly investigated physician expenditures based on the number of tests ordered across all surgical fields on a national scale.

Conclusion

To our knowledge, our study is the first of its kind to investigate on a national level the annual expenditures ($8.2 billion) associated with orthopedic surgeons for imaging studies, laboratory tests, specialty referrals, and hospital admissions. Due to continuously increasing healthcare costs, the factors and demographics associated with the highest expenditure elucidated in this study may help orthopedists become more mindful in reducing costs. Mechanisms other than reimbursement schedule cuts should be in place in order to lower national healthcare expenditure.

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