Do Practice Settings Influence Defensive Medicine in Orthopedic Surgery?

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Abstract

Defensive medicine is often practiced out of fear of legal liability.

We conducted a study to compare the costs of defensive medicine among US orthopedic surgeons by practice type and American Medical Association (AMA) state medical liability classification. Two thousand surgeons registered with the American Academy of Orthopaedic Surgeons were sent a survey on defensive medicine. Costs were analyzed using 2011 Centers for Medicare and Medicaid Services data. Of the 2000 surgeons, 1214 (61%) completed the survey.

Results showed that defensive tests were ordered by a higher proportion of nonacademic physicians than academic physicians in all 8 categories of orthopedic care, with a mean difference of $2348 in monthly defensive expenditures between groups. A higher rate of defensive testing by orthopedists in AMA crisis states versus safe states was also observed in 6 of the 8 areas of care studied, with mean monthly defensive expenditures ranging from $9208 in crisis states to $6596 in safe states.

Defensive orthopedics contributes significantly to health care costs, with marginal benefit to patients—especially in nonacademic and crisis-state orthopedics practices.

Total US health spending increased from 13.8% of gross domestic product (GDP) in 2000 to 17.9% in 2010,[1] which equates to $2.6 trillion overall or $8402 per person.[2] Almost 20% of these expenses were allocated to physician and clinical services spending.[3] As health care expenditures have risen, a major driver of these costs has become the administration of tests and procedures by health care providers to avoid medical malpractice claims, otherwise known as *defensive medicine*. In one study, more than 96% of orthopedic surgeons reported ordering procedures out of concern for medical liability, leading to an estimated $2 billion in costs annually.[4]

The American Medical Association (AMA) made a list of states considered to be in the midst of medical liability crisis, in which unaffordable insurance compels physicians to retire early, abandon performing high-risk procedures, or move to states with more stable insurance climates.[5] Results from a few recent studies have shown an association between crisis states and higher defensive practices in several specialities.[6,7] In addition, the likelihood that physicians either will be sued for malpractice or will pursue defensive medicine has also been correlated with type of practice setting.[8,9]

Although other investigators have reported on defensive medicine practices within the field of orthopedics,[4,10,11] the incidence and costs of defensive medicine practices among US orthopedic surgeons by state medical liability climate and academic practice setting have yet to be investigated. To gain a clearer understanding of the factors that influence defensive medicine practices, we report both defensive spending practices and the estimated costs of services from a national survey administered to a random sample of 2000 orthopedic surgeons.

Materials and Methods

We received approval from our institutional review board to e-mail to a random sample of 2000 orthopedic surgeons registered with the American Academy of Orthopaedic Surgeons (AAOS) a link to an anonymous Internet-based survey, administered through the AAOS Healthcare Statistics and Research Surveys Unit. The e-mail stated that the AAOS Medical Liability Committee and the Washington Health Policy Fellows were interested in asking respondents about their frequency of ordering different tests, procedures, admissions, and consultations. In addition, the e-mail stated that the purpose of the survey was to determine the practice of defensive medicine among US orthopedic surgeons and the resultant financial effects of such behavior. E-mail invitations were initially sent to selected orthopedists in September 2010, and reminder e-mails with a link to the original survey were sent every 2 weeks thereafter. Survey administration lasted 3 months, and data collection ended in December 2010. No incentives were provided for participation.

The survey consisted of 7 questions on demographics,

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Table I. Demographic Information for Survey Respondents With Completed Responses Sufficient for Analysis by Practice Type (Academic vs Nonacademic)

Demographic	Academic	Nonacademic	*P*
Mean Age, y	50.5	52.2	.007
Sex, n (%)			.191
Male	167 (91.3%)	947 (93.6%)	
Female	13 (7.1%)	42 (4.2%)	
Missing	3 (1.6%)	23 (2.3%)	
US Practice Location, n (%)			.005
Northeast	53 (29.3%)	181 (18.1%)	
South	47 (26.0%)	332 (33.2%)	
Midwest	34 (18.8%)	217 (21.7%)	
West	47 (26.0%)	270 (27.0%)	

Table II. Demographic Information for Survey Respondents With Completed Responses Sufficient for Analysis by State (as Defined by AMA Medical Liability Classification)

Demographic	Crisis	Borderline	Safe	*P*
Mean Age, y	51.2	51.4	53.1	.021
Sex, n (%)				.465
Male	568 (93.7%)	255 (91.4%)	284 (94.0%)	
Female	27 (4.5%)	14 (5.0%)	13 (4.3%)	
Missing	11 (1.8%)	10 (3.6%)	5 (1.7%)	
Practice Setting, n (%)				< .001
Private practice solo	81 (13.4%)	29 (10.4%)	55 (18.2%)	
Private practice orthopedic group	305 (50.3%)	152 (54.5%)	126 (41.7%)	
Private practice multispecialty group	59 (9.7%)	26 (9.3%)	32 (10.6%)	
Academic practice	106 (17.5%)	34 (12.2%)	42 (13.9%)	
Nonmilitary government/public entity	4 (0.7%)	2 (0.7%)	7 (2.3%)	
PPO/HMO	4 (0.7%)	5 (1.8%)	14 (4.6%)	
Clinical hospital	34 (5.6%)	26 (9.3%)	15 (5.0%)	
Other group	13 (2.1%)	5 (1.8%)	11 (3.6%)	
US Practice Location, n (%)				< .001
Northeast	209 (34.9%)	25 (9.0%)	0 (0.0%)	
South	189 (31.6%)	95 (34.1%)	87 (29.5%)	
Midwest	122 (20.4%)	74 (26.5%)	55 (18.6%)	
West	79 (13.2%)	85 (30.5%)	153 (51.9%)	< .001

including practice setting and practice location, as well as questions on medical liability. The survey specifically asked respondents to estimate the total number of tests or procedures ordered in 8 areas of orthopedic care in a typical month: plain radiographs, computed tomography (CT), magnetic resonance imaging (MRI), ultrasonography, specialty referrals or consultations, laboratory tests, biopsies and aspirations, and hospital admissions. The survey also asked respondents to estimate the number of these tests or procedures ordered in a typical month out of concerns about liability. The survey used check items and drop-down boxes to minimize survey-taking time. Questions were ordered logically to improve survey flow and to minimize recall error. Use of simple, direct sentences was based on principles adapted from a 2009 set of survey guidelines.[12] The survey was adapted with permission from a validated study by Studdert and colleagues[13] and, for further validation, was administered to the same consulting and focus groups they used.

Current Procedural Terminology (CPT) codes from the 2011 AMA "relative value search" database were used for cost analysis. CPT codes applicable to the 8 areas of orthopedic care were identified based on independent reviews from 3 practicing orthopedic trauma surgeons at a level I trauma center. Any CPT code not independently identified by these 3 surgeons was not included in the analysis. A flat dollar value was assigned to each CPT code identified using 2011 Centers for Medicare and Medicaid Services (CMS) relative values. A single "per-procedure" or "per-test" cost was calculated for each area of orthopedic care by averaging the flat dollar values of all CPT codes in a given area. These calculated "per-procedure" values were then used with respondents' answers to determine the mean monthly and yearly expenditures associated with each respondent.

Resultant extrapolations, analysis, and statistical comparisons were performed using standard statistical software that provided the mean, median, standard deviation, minimum value, maximum value, confidence intervals, and P values for survey items and statistical tests. Nonparametric analysis of variance and *t* tests were used to determine statistical differences in expenditures between the 8 areas of orthopedic care for orthopedic surgeons and to assess any statistically significant differences in expenditures by state medical liability status (crisis state, borderline state, and safe state, as defined by AMA) or type of practice (academic vs nonacademic).

Results

Demographics

Of the 2000 orthopedic surgeons, 1214 (61%) completed and returned the survey

Table III. **Mean (SD) Monthly Defensive Costs in 8 Areas of Orthopedic Care, by Practice Type (Academic vs Nonacademic)**

Area of Care	Academic vs Nonacademic	A. Mean No. per Month[a]	B. Mean No. Defensive per Month[b]	C. Mean Cost per Test or Procedure	D. Mean Total Cost per Month (A×C)	E. Mean Cost From Defensive Concerns (B×C)
Plain radiographs	A	176.9 (156.8)	26.5 (50.2)	$39.05	$6908.93 ($6124.63)	$1035.73 ($1959.90)
	N	195.6 (165.5)	39.3 (66.0)	$39.05	$7638.20 ($6462.76)	$1535.02 ($2575.87)
Computed tomography	A	10.1 (12.3)	1.7 (2.7)	$335.13	$3375.38 ($4135.29)	$567.91 ($909.80)
	N	6.4 (7.8)	1.9 (3.3)	$335.13	$2146.06 ($2605.42)	$629.52 ($1114.75)
Magnetic resonance imaging	A	19.9 (24.6)	5.9 (11.8)	$528.98	$10,537.04 ($13,023.98)	$3128.28 ($6257.39)
	N	29.8 (30.3)	9.4 (15.6)	$528.98	$15,784.10 ($16,013.90)	$4968.53 ($8257.17)
Ultrasonography	A	4.0 (4.0)	1.1 (2.4)	$138.26	$558.90 ($546.92)	$155.84 ($327.16)
	N	5.1 (6.1)	2.4 (4.2)	$138.26	$700.35 ($846.38)	$331.51 ($575.65)
Specialty referrals	A	15.0 (14.9)	4.0 (6.0)	$109.13	$1636.95 ($1621.75)	$436.52 ($649.59)
	N	12.0 (16.9)	4.5 (9.0)	$109.13	$1312.15 ($1845.51)	$487.02 ($987.22)
Laboratory tests	A	103.8 (489.3)	22.3 (158.1)	$17.78	$1846.17 ($8699.47)	$395.52 ($2810.99)
	N	45.5 (105.3)	10.9 (23.6)	$17.78	$808.87 ($1872.04)	$193.69 ($419.03)
Biopsies and aspirations	A	6.3 (7.9)	1.0 (1.9)	$133.99	$841.73 ($1062.76)	$132.84 ($260.06)
	N	10.5 (16.8)	1.9 (4.9)	$133.99	$1405.91 ($2245.98)	$256.16 ($649.87)
Hospital admissions	A	21.5 (19.1)	1.2 (4.4)	$381.00	$8192.70 ($7288.19)	$445.70 ($1686.11)
	N	17.2 (15.4)	1.3 (3.7)	$381.00	$6549.23 ($5872.20)	$485.81 ($1410.01)

[a]Mean total number of tests or procedures ordered in a month.
[b]Mean number of tests or procedures ordered in a month for defensive concerns.

during the 3-month administration period. Of the 1214 respondents, 1187 completed responses sufficient for analysis by state classification, and 1195 completed responses sufficient for analysis by type of practice. Basic demographic information for survey respondents is listed in **Tables I and II**. Mean age of academic and nonacademic physician respondents was 50.5 years and 52.2 years, respectively. There was no significant difference in sex based on academic affiliation or AMA state medical liability classification. There were group differences in practice location and practice setting distribution, with survey respondents predominantly from private practice orthopedic groups.

Monthly Expenditures by Type of Practice

The average academic orthopedic surgeon practiced defensive medicine most often with MRI, whereas the average nonacademic orthopedic surgeon practiced defensive medicine most often with ultrasonography (**Table III**). Compared with their academic counterparts, nonacademic orthopedists on average engaged more often in defensive medicine practices in all 8 categories, with the largest differences being in ultrasonography and CT (**Table III**). Compared with academic orthopedists, orthopedic surgeons practicing in a nonacademic setting were 19.6% more likely to order defensive ultrasonography and 12.9% more likely to order CT (**Table III**).

Aggregate weighted calculations revealed that the average academic respondent spent 17.8% of all monthly expenditures on defensive medicine practices; the average nonacademic orthopedist spent 22.7%. This corresponds to means of $6004 (academic orthopedists) and $8352 (nonacademic orthopedists) (**Table IV**). Given the number of academic (2448) and nonacademic (17,952) orthopedic surgeons in the United States (based on 2010 AAOS census data), national defensive expenditures each year for orthopedic surgeons are a combined $1.98 billion, with nonacademic orthopedists contributing more than 91% of this cost.

There were no significant differences in total monthly expenditures between academic and nonacademic surgeons in comparisons of all 8 areas of orthopedic care together ($P = .274$) (**Table IV**). However, the differences in overall defensive monthly expenditures and proportion of defensive spending per month were significant ($P \leq .001$) (discussed below).

Monthly Expenditures Based on AMA Malpractice Liability Classification

According to aggregate weighted calculations, the average orthopedist practicing in an AMA crisis state spent 23.5% of all monthly expenditures on defensive medicine practices, which corresponded to $110,496 (**Table V**). The proportions for borderline and safe states were 21.0% and 19.6%, respectively.

Table IV. Annual National Defensive Medicine Expenditures for Orthopedists by Practice Type (Academic vs Nonacademic)

	Academic	Nonacademic	*P*
A. Mean (SD) total expenditure per month	$31,895 ($22,437)	$33,684 ($23,719)	.274
B. Mean (SD) defensive expenditure per month	$6004 ($8864)	$8352 ($11,575)	< .001
C. Mean (SD) % of defensive spending per month (weighted)	17.8% (18.9%)	22.7% (20.2%)	< .001
D. Mean yearly defensive expenditure per orthopedist (B×12)	$72,048	$100,224	.274
E. No. of practicing US orthopedists	2448	17,952	—
F. Mean yearly total defensive expenditure (D×E)	$176.4 million	$1.80 billion	—

Table V. Annual National Defensive Medicine Expenditures for Orthopedists by State (as Defined by AMA Medical Liability Classification)[a]

	Crisis	Borderline	Safe
A. Total expenditure per month	$36,490	$30,391	$30,259
B. Defensive expenditure per month	$9208	$6910	$6596
C. % of defensive spending per month (weighted)	23.5%	21.0%	19.6%
D. Mean yearly expenditure per orthopedist (B×12)	$110,496	$82,920	$79,152
E. No. of practicing orthopedists	11,980	5038	6434
F. Mean yearly total defensive expenditure (D×E)	$1.32 billion	$417 million	$509 million

[a]All *P*s < .001.

As 11,980 orthopedists are practicing in crisis states (based on 2010 AAOS census data), national defensive expenditures each year for this group may be as high as $1.32 billion, with orthopedists in borderline and safe states contributing an additional $926 million.

In 6 of the 8 categories studied, orthopedists practicing in crisis states ordered a larger percentage of defensive tests than orthopedists in borderline and safe states did, with plain radiographs and laboratory tests being the outliers (**Table VI**). The largest difference in defensive practices between states was in ultrasonography, with orthopedists in crisis states being 2.3% more likely to order ultrasonography than those in noncrisis states. MRI was the largest contributor to defensive medicine costs among orthopedists in all states, regardless of AMA medical liability classification. Orthopedists in crisis states spent the least on laboratory tests, and those in borderline and safe states spent the least on biopsies and aspirations (**Table VI**).

Liability Reform

Compared with 68.9% of academic orthopedists, 86.5% of nonacademic orthopedists responded they would order fewer tests or procedures if significant medical liability reform occurred (P ≤ .001) (**Table VII**). In addition, compared with 52.2% of academic orthopedists, 72.7% of nonacademic orthopedists responded they reduced the number of high-risk patients or procedures out of concerns about liability (P ≤ .001) (**Table VII**).

Answers to questions about liability reform were not significantly different between respondents' grouped by state classifications (**Table VIII**). Of the orthopedists in all the states, regardless of AMA medical liability classification, 82% to 87% responded they would order fewer tests or procedures each month if significant liability reform protected physicians, and 69% to 74% responded they had reduced their number of high-risk patients or procedures out of liability concerns in the past 5 years.

Discussion

Characterizing defensive medicine among orthopedists is an important first step in understanding how to curb rising health care costs in the field. Our results showed that, compared with academic physicians, nonacademic physicians reported practicing defensive medicine more often and with higher associated costs in 8 procedural areas. Evidence also showed that increase in defensive medicine practices was associated with AMA state medical liability classification. A few other investigators have reported similar results for physicians in other specialties. Babu and colleagues[6] found that neurosurgeons in crisis states were more likely to perform defensive practices, including increasing use of laboratory and imaging tests and suggesting outside consultations. Anderson and colleagues[7] reported that obstetricians and gynecologists who were providing breast care in crisis states reported to more often ordering screenings and tests out of fear of litigation than obstetricians and gynecologists in stable states.

By extrapolation, the total annual defensive expenditure calculated in this study represents approximately 0.38% of all physician and clinical services spending in the orthopedic

Table VI. **Mean (SD) Monthly Defensive Costs in 8 Areas of Orthopedic Care by State (as Defined by AMA Medical Liability Classification)**

Area of Care	Crisis, Borderline, Safe	A. Mean No. per Month[a]	B. Mean No. of Defensive per Month[b]	C. Mean cost per test or procedure	D. Mean Total Cost per Month (A×C)	E. Mean Cost From Defensive Concerns (B×C)
Plain radiographs	C	207.2 (187.2)	40.1 (64.5)	$39.05	$8089.61 ($7311.82)	$1566.22 ($2517.01)
	B	181.9 (125.0)	34.3 (53.8)	$39.05	$7104.02 ($4881.37)	$1338.12 ($2102.58)
	S	176.1 (145.7)	35.1 (71.8)	$39.05	$6874.70 ($5688.00)	$1369.61 ($2803.91)
Computed tomography	C	7.5 (9.2)	2.1 (3.6)	$335.13	$2501.37 ($3094.44)	$711.04 ($1194.19)
	B	6.6 (7.1)	1.7 (3.1)	$335.13	$2215.66 ($2386.88)	$583.42 ($1034.36)
	S	6.4 (9.3)	1.4 (2.6)	$335.13	$2144.57 ($3105.89)	$463.73 ($871.76)
Magnetic resonance imaging	C	31.6 (31.5)	10.4 (15.9)	$528.98	$16,703.28 ($16,680.92)	$5480.82 ($8430.46)
	B	25.1 (25.9)	7.4 (12.3)	$528.98	$13,250.65 ($13,687.25)	$3938.19 ($6530.13)
	S	25.0 (28.7)	7.2 (15.7)	$528.98	$13,198.24 ($15,197.08)	$3785.40 ($8308.19)
Ultrasonography	C	5.3 (6.2)	2.6 (4.0)	$138.26	$738.12 ($859.34)	$355.79 ($557.63)
	B	4.5 (4.7)	2.1 (4.1)	$138.26	$627.73 ($643.64)	$294.00 ($566.19)
	S	4.3 (6.0)	1.5 (3.6)	$138.26	$596.25 ($830.34)	$204.25 ($495.53)
Specialty referrals	C	14.1 (18.6)	5.2 (9.0)	$109.13	$1540.54 ($2031.35)	$566.98 ($983.43)
	B	10.3 (10.7)	3.4 (5.1)	$109.13	$1127.08 ($1171.77)	$368.53 ($555.46)
	S	11.2 (16.6)	3.7 (10.2)	$109.13	$1222.50 ($1815.45)	$407.63 ($1112.18)
Laboratory tests	C	60.8 (291.0)	13.9 (88.7)	$17.78	$1080.58 ($5173.97)	$246.22 ($1576.98)
	B	47.9 (71.0)	11.4 (27.0)	$17.78	$851.61 ($1261.79)	$202.31 ($479.41)
	S	48.2 (100.0)	11.3 (26.0)	$17.78	$856.49 ($1775.97)	$201.68 ($463.09)
Biopsies and aspirations	C	11.2 (16.4)	2.2 (5.3)	$133.99	$1505.55 ($2197.74)	$295.98 ($710.54)
	B	6.7 (10.5)	1.2 (3.0)	$133.99	$903.22 ($1410.98)	$161.07 ($398.13)
	S	10.2 (18.6)	1.5 (4.1)	$133.99	$1366.56 ($2491.49)	$197.57 ($554.77)
Hospital admissions	C	18.4 (16.9)	1.4 (3.9)	$381.00	$7011.34 ($6435.57)	$519.47 ($1479.11)
	B	17.9 (17.5)	1.2 (3.3)	$381.00	$6496.97 ($4893.99)	$444.22 ($1252.93)
	S	17.1 (12.8)	1.1 (4.2)	$381.00	$6807.62 ($6686.24)	$434.53 ($1611.45)

[a]Mean total number of tests or procedures ordered in a month.
[b]Mean number of tests or procedures ordered in a month for defensive concerns.

population. Although this number may seem small, reductions in defensive medicine remain an important source of reducing costs without diminishing quality of patient care. A vast majority of the orthopedists in our study responded they would order fewer unnecessary tests and procedures each month if there were significant medical liability reform. It is interesting that the responses to this question were similar across all AMA liability classification groups, suggesting potential for reductions in defensive spending regardless of state liability climate. More than 70% of nonacademic respondents and more than 50% of academic respondents further stated they had reduced the number of high-risk patients and procedures they saw out of liability concerns.

Our study was limited by our use of self-report surveys. The response rate of our e-mail survey was 61%. This may have given rise to sampling bias. Our results were also dependent on respondents' recall ability. In addition, respondents who did not mark responses for any of the 8 areas of orthopedic care

Table VII. Liability Concerns for Academic and Nonacademic Orthopedists[a]

Concern	Academic, yes	Nonacademic, yes
Would you order fewer tests or procedures if there was significant medical liability reform?	68.9%	86.5%
In the past 5 years, did you reduce the number of high-risk patients or procedures due to concerns about liability?	52.2%	72.7%

[a]*P*s < .001.

Table VIII. Liability Concerns for Orthopedists by State (as Defined by AMA Medical Liability Classification)

Concern	Crisis, yes	Borderline, yes	Safe, yes	*P*
Would you order fewer tests or procedures if there was significant medical liability reform?	85.3%	86.1%	82.3%	.497
In the past 5 years, did you reduce the number of high-risk patients or procedures due to concerns about liability?	69.3%	69.9%	73.5%	.531

assessed in this study were considered having "missing" values instead of "zero" values, and we had to weight our analysis accordingly. Moreover, cost calculations used a conservative approach—a single calculated average per-procedure cost for each of the 8 areas studied. Using a single cost multiplier would underestimate the actual defensive expenditures associated with respondents. For hospital admissions, only a single CPT code was used for observation between 8 and 24 hours. Also, any CPT code not independently identified for inclusion by the authors was not included in the study. Therefore, our study may have potentially excluded CPT codes used by some survey respondents, therefore contributing to lower calculated defensive expenditures. Overall, some caution must be exercised in extrapolating the results obtained in this study to the overall orthopedic surgeon community.

For objective results and a better understanding of the true costs of defensive medicine practices in orthopedics, additional research studies—not based on self-reported surveys of past practices—are needed. Orthopedists are also prone to practicing defensive medicine in several other procedures (not previously studied), including administration of deep vein thrombosis prophylaxis, prolonged antibiotic use, and use of generic implants or medicines.

Our study provides an initial look at defensive medical practice rates between orthopedists on the basis of state medical liability climate and practice type. In both cases, significant differences in defensive spending were found. Our study highlights the importance of reducing defensive medicine expenditures in orthopedics to controlling health care costs, and suggests identifying effective means of doing so as a topic for further investigation.

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