Clin Orthop Relat Res (2015) 473:1111–1117
DOI 10.1007/s11999-014-3912-3

Clinical Orthopaedics and Related Research®
A Publication of The Association of Bone and Joint Surgeons®

CLINICAL RESEARCH

Medical Services and Associated Costs Vary Widely Among Surgeons Treating Patients With Hand Osteoarthritis

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Received: 19 May 2014 / Accepted: 19 August 2014 / Published online: 30 August 2014

Abstract

Background There are substantial variations in medical services that are difficult to explain based on differences in pathophysiology alone. The scale of variation and the number of people affected suggest substantial potential to lower healthcare costs with the reduction of practice variation. Our study assessed practice variation across three affiliated urban sites in one city in the United States and related healthcare costs following the diagnosis of hand osteoarthritis (OA) in patients.

Questions/purposes (1) What are the factors associated with increased costs and surgery in the first year after diagnosis of hand OA? (2) How much practice variation exists among hand surgeons in terms of the number of patient visits, use of imaging tests, use of injections, occupational therapy use, and surgery? (3) What proportion of total cost is accounted for by patients who consult with an additional provider?

Methods Patients receiving a new diagnosis of primary hand OA between January 1, 2007, and December 31, 2011, were identified from the research database of three affiliated urban hospitals in a single city in the United States. We included 2814 patients (69%, 1929 women) treated by six hand surgeons. We recorded all visits, imaging tests, injections, occupational therapy visits, and surgical procedures in the first year after that diagnosis. Costs were extracted from the Medicare Physician Fee Schedule. Reliability of the database was assessed by manual checking of 120 patient charts (4.3% of all data); reliability was determined to be 94% (113 of 120) for diagnoses, 97% (116 of 120) correct surgeon, 100% (120 of 120) second surgeon, 99% (278 of 282) visits, 99% (132 of 134) imaging procedures, 92% (11 of 12) injections, 95% (21 of 22) surgical procedures, and 85% (102 of 120) prescribing occupational therapy.

One of the authors (SJEB) is supported by Dutch research grants from Anna Foundation|NOREF (less than USD 10,000) (Oegstgeest, The Netherlands), Genootschap Noorthey (less than USD 10,000) (Bussum, The Netherlands), Stichting Fonds Doctor Catharine van Tussenbroek (less than USD 10,000) (Amsterdam, The Netherlands), and Stichting Vreedefonds (less than USD 10,000) (Amsterdam, The Netherlands). One of the authors (TT) received research grants from the Prince Bernhard Culture Fund & Kuitse Fung (less than USD 10,000) (Amsterdam, The Netherlands) and Fundatie van de Vrijvrouwe van Renswoude te's-Gravenhage (less than USD 10,000) (The Hague, The Netherlans). One of the authors (DR) certifies that he, or a member of his immediate family, has or may receive payments or benefits, during the study period from Wright Medical (less than USD 10,000) (Memphis, TN, USA); Skeletal Dynamics (less than USD 10,000) (Miami, FL, USA); Biomet (less than USD 10,000) (Warsaw, IN, USA); AO North America (less than USD 10,000) (Paoli, PA, USA); and AO International (less than USD 10,000) (Dubendorf, Switzerland).
All ICMJE Conflict of Interest Forms for authors and *Clinical Orthopaedics and Related Research*® editors and board members are on file with the publication and can be viewed on request.
Each author certifies that his or her institution approved the human protocol for this investigation and that all investigations were conducted in conformity with ethical principles of research.
Two of the authors (SJEB, TT) contributed equally.

Electronic supplementary material The online version of this article (doi:10.1007/s11999-014-3912-3) contains supplementary material, which is available to authorized users.

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Results Predictors of increased costs included younger patient age (regression coefficient [β] −3.5, semipartial R^2 0.0049, 95% confidence interval [CI] −5.4 to −1.7, $p < 0.001$), seeing a second surgeon (β 283, semipartial R^2 0.0095, 95% CI 176–391, $p < 0.001$), and specific surgeons (surgeon 1: β −243, semipartial R^2 0.026, 95% CI −298 to −188, $p < 0.001$; surgeon 2: β −177, semipartial R^2 0.0090, 95% CI −246 to −109, $p < 0.001$; surgeon 6: β 124, semipartial R^2 0.0050, 95% CI 59–189, $p < 0.001$) (adjusted $R^2 = 0.056$). Similarly, factors associated with increased surgical intervention included younger patient age (β −0.0026, semipartial R^2 0.0071, 95% CI −0.0037 to −0.0015, $p < 0.001$), male sex (β 0.041, semipartial R^2 0.0028, 95% CI −0.069 to −0.012, $p = 0.005$), seeing a second surgeon (β 0.16, semipartial R^2 0.0091, 95% CI 0.094–0.22, $p < 0.001$), and specific surgeons (surgeon 1: β −0.14, semipartial R^2 0.026, 95% CI −0.18 to −0.11, $p < 0.001$; surgeon 2: β −0.13, semipartial R^2 0.014, 95% CI −0.17 to −0.091, $p < 0.001$). There were large variations in the average number of visits (1.5-fold), imaging tests (threefold), use of injections (51-fold), occupational therapy (twofold), and surgery rates (sevenfold) among providers. One hundred twenty patients (4.3%) consulted a second surgeon within the first year after receiving the diagnosis of hand OA, which accounted for 8.1% (USD 68,826/USD 845,304) of the total costs.

Conclusions Patients who saw additional providers and who were of younger age incurred higher costs and a greater likelihood of undergoing surgery; the latter was also greater in male patients. Use of medical services and associated costs vary widely among providers treating patients with hand OA. Initiatives addressing practice variation—increased use of decision aids, for example—merit additional study.

Level of Evidence Level III, prognostic study. See the Instructions for Authors for a complete description of levels of evidence.

Introduction

Substantial variations in medical services are difficult to explain based on differences in pathophysiology [4, 24, 25]. Given that studying such variations has led to improved quality, safety, and resourcefulness in other fields [7], medical science is beginning to address variation in health care and methods for reducing it. Greater variation is observed in discretionary treatment of conditions that are part of normal human aging, including benign prostate hyperplasia and osteoarthritis (OA) [2, 16, 21]. For such conditions, variation in patient symptom intensity and magnitude of disability are often incompletely understood, and well-designed clinical trials comparing diagnostic and treatment strategies are scarce [22, 23]. In the absence of practice guidelines based on solid scientific evidence, it seems that medical decision-making may be largely determined by individual physician attitudes. The scope of variation and the number of people affected suggest enormous potential to reduce healthcare costs and improve the quality, safety, and efficiency of care through reduction in practice variation [8].

Hand OA is part of human aging and its treatment is largely discretionary. Without standardized treatment protocols, the diagnosis is prone to treatment variation. Our study measured this practice variation and related costs in the first year after the diagnosis of hand OA in patients. Specifically, we looked at the following: (1) What factors are associated with increased costs and surgeries during the first year after diagnosis of hand OA? (2) How much practice variation exists among hand surgeons in terms of the number of patient visits, use of imaging tests, use of injections, occupational therapy use, and surgical intervention in treating patients with hand OA? (3) What proportion of the total cost is accounted for by patients who consulted with an additional hand surgeon?

Materials and Methods

Patient Selection

After approval by our institutional review board, we examined a database containing all clinical encounters of three affiliated urban hospitals in a single city in the United States for eligible patients for this retrospective study [17]. We defined hand OA as any primary OA occurring at or beyond the carpometacarpal joints. Data were retrieved for any patients who received an ICD-9 code pertaining to hand OA (715.04, 715.14, 715.93, or 715.94) from September 16, 1991 (date of first registered hand OA ICD-9 code) through December 31, 2012 (n = 7363). We included all patients diagnosed between January 1, 2007, and December 31, 2011, resulting in a minimum possible followup of 1 year. Subsequently, to identify only newly diagnosed patients, using the same ICD-9 codes, we excluded patients who had received a diagnosis of hand OA by any healthcare provider in our system before the defined time period for our study (n = 3042 excluded).

To create a homogenous sample, patients diagnosed with inflammatory arthritis, systematic inflammatory illness likely to involve joints, or secondary OA of the hand any time before or within 1 year of their hand OA

Table 1. Baseline characteristics of hand surgeons' practices

Provider	Number of patients (N = 2814)	Women	Age (years ± SD)	Concomitant hand diagnosis	Sodha 1	Sodha 2	Sodha 3	Additional provider within our system
Surgeon 1	613	62% (378)	62 (± 12)	65% (399)	42% (25)	37% (22)	22% (13)	4.4% (27)
Surgeon 2	348	70% (242)	61 (± 12)	55% (193)	45% (27)	38% (23)	17% (10)	2.0% (7)
Surgeon 3	297	80% (238)	62 (± 11)	56% (166)	23% (14)	32% (19)	45% (27)	5.7% (17)
Surgeon 4	446	72% (319)	62 (± 12)	66% (293)	30% (18)	35% (21)	35%(21)	3.4% (15)
Surgeon 5	709	67% (472)	62 (± 11)	67% (478)	32% (19)	32% (19)	37% (22)	5.9% (42)
Surgeon 6	401	70% (280)	62 (± 12)	43% (175)	32% (19)	37% (22)	32% (19)	3.0% (12)
Mean	2814	69% (1929)	62 (± 12)	61% (1704)	34% (122)	35% (126)	31% (112)	4.3% (120)
p value		< 0.001	0.57	< 0.001	0.081			0.022

Discrete variables as percentage (number); Sodha scale rates trapeziometacarpal joint osteoarthritis severity using a three-point scale: none, definite, destroyed trapeziometacarpal joint [19].

diagnosis were also excluded (n = 1461) (Appendix 1 [Supplemental materials are available with the online version of CORR®.]). We did not exclude patients with additional upper extremity diagnoses (such as fracture, trigger finger, or carpal tunnel syndrome).

To account for possible confounding of additional hand diagnoses, we recorded if patients received an additional diagnosis (other than our exclusion criteria) by their hand surgeon 6 months before or within 1 year of their hand OA diagnosis and treated such occurrences as an independent variable.

After patient selection, we included the six providers with more than 100 patients (excluding one provider and 46 patients) to ensure a representative sample of patients with hand OA in each surgeon's practice. All hand surgeons completed orthopaedic residency training, completion date ranged from 1975 to 2007, and four hold a subspecialty certificate in hand surgery by the American Society for Surgery of the Hand. Our final cohort consisted of 2814 patients with an average age of 62 ± 12 years (range, 16–98 years); 69% (n = 1929) of our study patients were women (Table 1). All procedures performed after the initial diagnosis of hand OA were ascribed to the provider who gave the initial diagnosis.

Provider's Practice

To assess for possible differences in pathophysiology among providers' practices, we randomly selected 60 radiographs per provider (post hoc power analysis: 0.83 power, alpha 0.05, chi-square test). Two investigators, independently, blinded for the treating surgeon, rated the trapeziometacarpal joint for OA severity using the three-point scale of Sodha et al. (none, definite, destroyed trapeziometacarpal joint) [19]. We found no difference in patient OA severity among providers' practices using bivariate analysis (Table 1). Ordered logistic regression showed age to be the only predictor for OA severity (odds ratio 1.1, pseudo R^2 0.065, 95% CI 1.05–1.08, $p < 0.001$).

Additionally, we manually reviewed the medical records of 20 randomly selected patients for each provider. Of the patients reviewed in detail, 60% sought care for OA of the thumb (45% trapeziometacarpal, 3% metacarpophalangeal, and 12% interphalangeal); 31% sought care for OA of the other digits; and 9% had OA that involved both the thumb and other digits. We found no difference in joints affected among providers (p = 0.68; post hoc power analysis: 0.75 power, alpha 0.05, chi-square test).

Because of the nature of our data, we could not track patients seeking care outside our hospital system. We did track patients seeing another hand surgeon within our system; this proportion ranged between surgeons from 2.0% (seven of 348) to 5.9% (42 of 709) (p = 0.022) (Table 1). To account for any possible confounding, we recorded such occurrence as an independent variable (Tables 2, 3).

Of all 120 patients seeing an additional provider, we matched the subset of 79 patients with a hand radiograph for age and sex to patients only seeing one hand surgeon (ratio 1:1). Again, we rated trapeziometacarpal joint OA severity by Sodha grading. We found no difference in OA severity between patients on bivariate analysis (additional provider: grade 1 20% [16 of 79], grade 2 48% [38 of 79], grade 3 32% [25 of 79] versus matched controls: grade 1 18% [14 of 79], 53% [42 of 79], grade 3 29% [23 of 79]; p = 0.93) (post hoc power analysis: 1.0 power; alpha 0.05, Wilcoxon signed rank sum test).

Outcome Measures

Using Current Procedural Terminology (CPT, Appendix 2 [Supplemental materials are available with the online version of CORR®.]) and ICD-9 codes, we identified all visits, patients with only a single visit, imaging tests, injections, and surgical procedures related to hand OA during the first year

Table 2. Multivariable analysis predictors for costs and surgery

Cost factors	Regression coefficient (β)	SE	95% confidence interval	p value	Semipartial R^2	Adjusted R^2
Age	–3.5	0.95	–5.4 to –1.7	< 0.001	0.0049	0.056
Additional provider	283	55	176–391	< 0.001	0.0095	
Surgeon 1	–243	28	–298 to –188	< 0.001	0.026	
Surgeon 2	–177	35	–246 to –109	< 0.001	0.0090	
Surgeon 6	124	33	59–189	< 0.001	0.0050	
Surgery						
Age	–0.0026	0.00058	–0.0037 to –0.0015	< 0.001	0.0071	0.048
Men	0.041	0.015	0.069–0.012	0.005	0.0028	
Additional provider	0.16	0.033	0.094–0.22	< 0.001	0.0091	
Surgeon 1	–0.14	0.017	–0.18 to –0.11	< 0.001	0.026	
Surgeon 2	–0.13	0.021	–0.17 to –0.091	< 0.001	0.014	

Table 3. Bivariate analysis predictors of cost and surgery

Continuous	Costs (USD)*	p value	Surgery*	p value
Patients' age (years) (ρ)	–0.054	0.0042	–0.066	< 0.001
Dichotomous*				
Men	319 (± 594)	0.012	0.14 (± 0.39)	0.014
Women	292 (± 606)		0.11 (± 0.35)	
Hand OA only	336 (± 696)	0.62	0.13 (± 0.38)	0.29
Concomitant hand diagnosis	277 (± 532)		0.11 (± 0.36)	
Single provider	288 (± 590)	< 0.001	0.11 (± 0.35)	< 0.001
Additional Provider	574 (± 785)		0.28 (± 0.53)	
Injection			0.094 (± 0.29)	0.56
No injection			0.11 (± 0.31)	

*Presented as mean (± SD); OA = osteoarthritis.

after patient diagnosis. In addition, we recorded if patients had an occupational therapy visit within 3 months of their hand OA diagnosis. Investigators, who were blinded to the treating surgeon, not involved with the treatment of the patients established our outcome measures.

Costs were estimated from the searchable Medicare Physician Fee Schedule provided by the Centers for Medicare & Medicaid Services, using the 2009 facility priced national payment amount [18]. Using this method only provides a physician fee for CPT codes and does not account for procedures registered by ICD-9 codes; therefore, ICD-9 codes were matched to a corresponding CPT code to allow for estimation of costs.

Reliability of the Database

At the start of the study, we realized that each hand surgeon had a different way of coding the diagnosis of hand OA. A survey was sent to each hand surgeon to determine their use of ICD-9 codes for hand OA so that we could be certain we had identified all qualifying patients in the database. When manually reviewing the medical records of 20 randomly selected patients for each provider, we documented 94% (113 of 120) accuracy of diagnosis, 97% (116 of 120) identification of the correct surgeon, and 100% (120 of 120) accuracy in identifying consultation of a second surgeon. In addition, our research database recorded 99% (278 of 282) of all visits, 99% (132 of 134) of all imaging procedures, 92% (11 of 12) of all injections, and 95% (21 of 22) of all surgical procedures. We identified 85% (102 of 120) prescribing occupational therapy (Appendix 3 [Supplemental materials are available with the online version of CORR®.]).

Statistical Analysis

Dichotomous variables were compared using the chi-square test. Except for costs, all continuous variables were compared using nonparametric tests. Cost data were normalized by logarithmic conversion before parametric testing. To identify independent predictors for surgery and costs, we created two multivariable models, including all variables with $p < 0.10$ on bivariable analysis, after changing all categorical values into dummy variables with the first variable exempted from analysis. A p value of < 0.05 was considered significant.

Results

Costs and Surgery

The final multivariable model for higher costs included younger patient age (regression coefficient [β] −3.5,

Table 4. Variation in surgeons' practices for patients with hand osteoarthritis (n = 2814)

Parameter	Costs (USD)	Visits	Single visit only	Imaging procedures	Injections	Occupational therapy	Surgical procedures
Overall mean	300 (± 602)	2.1 (± 1.6)	52% (1463)	0.96 (± 1.1)	0.11 (± 0.39)	35% (989)	0.12 (± 0.37)
Surgeon 1	114 (± 151)	1.6 (± 1.1)	67% (413)	0.36 (± 0.72)	0.0049 (± 0.07)	28% (169)	0.024 (± 0.16)
Surgeon 2	176 (± 248)	1.9 (± 1.4)	55% (191)	0.81 (± 0.85)	0.11 (± 0.41)	54% (187)	0.032 (± 0.18)
Surgeon 3	316 (± 558)	2.4 (± 1.9)	45% (297)	1.2 (± 1.3)	0.19 (± 0.52)	26% (77)	0.13 (± 0.45)
Surgeon 4	340 (± 623)	2.2 (± 1.7)	47% (211)	1.1 (± 1.3)	0.18 (± 0.49)	21% (95)	0.15 (± 0.39)
Surgeon 5	390 (± 690)	2.3 (± 1.7)	44% (310)	1.3 (± 0.96)	0.038 (± 0.21)	45% (321)	0.17 (± 0.43)
Surgeon 6	477 (± 917)	2.1 (± 1.6)	51% (204)	1.0 (± 1.2)	0.25 (± 0.58)	35% (140)	0.18 (± 0.45)
p value	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001	< 0.001

Continuous data presented as mean (± SD); discrete data as proportion (number).

semipartial R^2 0.0049, 95% confidence interval [CI] −5.4 to −1.7, $p < 0.001$), seeing a second surgeon (β 283, semipartial R^2 0.0095, 95% CI 176–391, $p < 0.001$), and specific surgeons (surgeon 1: β −243, semipartial R^2 0.026, 95% CI −298 to −188, $p < 0.001$; surgeon 2: β −177, semipartial R^2 0.0090, 95% CI −246 to −109, $p < 0.001$; surgeon 6: β 124, semipartial R^2 0.0050, 95% CI 59–189, $p < 0.001$) as independent predictors (adjusted $R^2 = 0.056$; Table 2). The model was derived after initial bivariate analyses: the average cost per patient was USD 300 ± USD 602 but differed fourfold among individual surgeons (range, USD 114–477 average per provider; $p < 0.001$; Table 4). Men incurred higher healthcare costs compared with women (USD 319 ± USD 594 versus USD 292 ± USD 606; $p = 0.012$; Table 3). Older patient age was associated with lower costs (ρ = –0.054; $p = 0.0042$); and seeing a second surgeon within the first year after diagnosis was associated with increased costs (USD 574 ± USD 785 versus USD 288 ± USD 590; $p < 0.001$).

Factors associated with increased surgical intervention in our final multivariate model included younger age (β −0.0026, semipartial R^2 0.0071, 95% CI −0.0037 to −0.0015, $p < 0.001$), male sex (β 0.041, semipartial R^2 0.0028, 95% CI −0.069 to −0.012, $p = 0.005$), seeing a second surgeon (β 0.16, semipartial R^2 0.0091, 95% CI 0.094–0.22, $p < 0.001$), and specific surgeons (surgeon 1: β −0.14, semipartial R^2 0.026, 95% CI −0.18 to −0.11, $p < 0.001$; surgeon 2: β −0.13, semipartial R^2 0.014, 95% CI −0.17 to −0.091, $p < 0.001$) (adjusted $R^2 = 0.048$; Table 2). Initial bivariate analyses revealed that the number of surgical procedures per patient with a new diagnosis of hand OA ranged more than sevenfold depending on the provider (overall mean, 12 ± 36 per 100 patients; range, 2.4–18 per 100 patients averaged by provider; $p < 0.001$; Table 4). Younger patients (ρ = –0.066; $p < 0.001$) and men were more likely to undergo surgery (men, 0.14 ± 0.39 versus women, 0.11 ± 0.35; $p = 0.014$). Consulting with an additional provider increased patient chance of having surgery nearly threefold (0.28 ± 0.53 versus 0.11 ± 0.35; $p < 0.001$). Previous injection was unrelated to surgery (injection 0.094 ± 0.29 versus no injection 0.11 ± 0.31; $p = 0.56$; Table 3).

Practice Variation

We found a difference in the number of visits, proportion of only a single visit, the use of imaging tests, injection, occupational therapy, and surgery per provider. On average, patients visited their hand surgeon 2.1 ± 1.6 times (range, 1.6–2.4) within the first year of hand OA diagnosis, depending on the provider ($p < 0.001$). The proportion of patients visiting their provider once varied between 44% (310 of 709) and 67% (413 of 613) ($p < 0.001$). Patients generally underwent one imaging procedure depending on the provider (0.96 ± 1.1 imaging procedures; range, 0.36–1.3; $p < 0.001$). Approximately one in 10 patients had their joint injected but injection use depended on the provider (0.11 ± 0.39 injections; range, 0.0049–0.25; $p < 0.001$) and one in three patients visited an occupational therapist, which also depended on the provider (35% [989 of 2814]; range, 21% [95 of 446] to 54% [187 of 348]; $p < 0.001$).

Second Surgeon

The 4.3% of patients (n = 120) who visited a second surgeon within the first year after their diagnosis of hand OA accounted for 8.1% of the total costs (single provider USD 288 ± USD 590 versus additional provider USD 574 ± USD 785; $p < 0.001$). Seeing a second surgeon was not associated with patient sex (women, 0.68 ± 0.46 versus men, 0.72 ± 0.45; $p = 0.45$) or age (not seeing an additional provider, 62 ± 12 years versus seeing an additional provider, 63 ± 12 years; $p = 0.66$). Patients who saw an additional provider did not have a higher rate of additional hand diagnosis (concomitant diagnosis one provider 54% [1624 of 2694] versus concomitant diagnosis and additional provider 67% [80 of 120], $p = 0.16$) with the number available.

Discussion

The use of medical services varies widely across providers, and the variation is difficult to explain only by differences in pathophysiology of the medical conditions in question. The scope of variation and the number of people affected suggest enormous potential to reduce healthcare costs with the reduction of practice variation. To test this assumption for hand OA, we assessed practice variation and related healthcare costs in the first year after patient diagnosis. Identification of substantial practice and cost variations in our study may help foster awareness of variations and direct research toward initiatives addressing optimal use of resources.

Our study has some limitations. The Medicare Physician Fee Schedule reflects surgeons' healthcare use costs but does not include costs for other healthcare providers (radiologists, occupational therapists, or anesthesiologists) and does not account for nonmedical costs such as time from work; therefore, the Fee Schedule does not reflect total healthcare costs. We found no difference in radiologic trapeziometacarpal joint OA severity between providers, but we could not assess other aspects of pathophysiology. Our study included an urban population living in relatively close proximity resulting in comparable surgeon practices—however, because of similar geographic location, our patient sample might not be representative of the general population. As a result of the nature of our data, we cannot differentiate between patients leaving our system satisfied after diagnosis (and possible treatment) and those seeking care with another hand surgeon outside our system. However, we did include patients seeking care with another hand surgeon affiliated with any of the three hospitals within our system and included this as a possible confounding factor in our analysis. Perhaps most importantly, the study of variation cannot determine the optimal use of discretionary treatments for conditions such as OA.

Female sex and older age are associated with greater pathophysiology [3, 19], but patients who saw additional providers and who were younger were associated with greater costs and greater likelihood of surgery; the latter also increased in male patients. With our large cohort of patients, those with less severe disease used more extensive medical services. A similar trend has been noted in patients with hip and knee OA [10]. This might be explained by differences in attitudes toward surgery between men and women, because some data suggest that women are more fearful of surgery than men, and women are more concerned about the postoperative recovery time, postoperative pain, risks of anesthesia, and complications [1]. Another study found that women are more willing to delay surgery to await better technology and avoid disrupting of their caregiver roles [12]. The high prevalence of hand OA that occurs with increasing age suggests that most people adapt to it [3, 5]. Delaying surgery, something that may come more naturally to women might prevent surgery altogether.

Among patients with a new diagnosis of hand OA, there is substantial variation in the number of visits (1.5-fold), use of injections (51-fold), occupational therapy (twofold), imaging tests (threefold), and surgery (sevenfold) determined by providers, leading to the conclusion that physician attitudes have an inordinate influence on medical decision-making [4]. Symptom intensity and magnitude of disability may influence some surgeons more than others. In other words, some surgeons are more influenced by symptoms and disability and others are more influenced by objective pathophysiology. Variations in the treatment of electrophysiologically normal carpal tunnel syndrome are an example of this phenomenon. Large variations in treatment approach can also be ascribed, in part, to the dearth of high-quality research on OA of the hand [22, 23]. In addition to high-level evidence and practice guidelines, variation may decrease with the development of methods for increasing patient involvement in their own care [14] by diminishing the influence of individual physician attitudes. Decision aids—tools to facilitate the shared decision-making process, ie, increasing patient participation [20]—in particular have resulted in a 20% decrease in proceeding with elective surgeries in other clinical areas such as knee replacement [11], prostatectomy for benign prostatic hypertrophy [15], and back surgery for herniated discs [6]. Decision aids that enhance patient involvement in decision-making by providing them with complete, balanced, evidence-based information, which they can review at their own pace, may decrease decisional conflict, that is, uncertainty about which course of action to take [20].

In our study, patients who consulted with another hand surgeon incurred an almost twofold increase in costs, and such consults nearly tripled the rate of surgery without having worse objective pathophysiology compared with controls. This suggests that the small percentage of patients who see surgery as their best hope may gravitate to surgeons who are more likely to offer it. So-called "doctor shopping" has been studied in other fields and has been associated with decreased patient satisfaction and with opioid addiction [9, 13]. Future research should focus on factors associated with seeking a second opinion in the field of hand surgery and the influence on final patient symptoms and disability.

Hand surgeons tend to assume that variations in care are associated with variations in pathophysiology and that patients with more advanced disease will seek more care. Our study builds on growing evidence that more or more expensive care does not correlate with more severe pathophysiology but appears more related to variations among surgeons than to variations in patient preferences and values. This suggests that methods to diminish the influence of surgeon bias might focus on more measured and deliberate decision-making and the provision of complete and balanced information that patients can understand, review at their leisure, and discuss with trusted family members and friends. It remains to be determined if more informed care will increase or decrease resource use and costs, but it seems fair to assume that decreased treatment variation by surgeons will reflect an increased influence of patient preferences and is therefore a measure of optimal respect for patients.

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