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# Attitudes and awareness of suture anchor cost: a survey of shoulder surgeons performing rotator cuff repairs

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**Background:** The cost of health care in the United States accounts for 18% of the nation's gross domestic product and is expected to reach 20% by 2020. Physicians are responsible for 60%-80% of decisions resulting in health care expenditures. Rotator cuff repairs account for $1.2-$1.6 billion in US health care expenditures annually. The purpose of this study is to assess surgeons' cost awareness in the setting of rotator cuff repairs. The hypothesis is that practice environment and training affect cost consciousness and incentivization will lead to more cost-effective choices.

**Methods:** In this cross-sectional study, a 21-item survey was distributed via the email list services of the American Shoulder and Elbow Surgeons and Arthroscopy Association of North America. Data collected included demographics, variables regarding rotator cuff repair (technique, number of companies used, procedures per month), and knowledge of costs.

**Results:** Responses from 345 surgeons in 23 countries were obtained with the majority (89%) being from the United States. Most surgeons were ''cost-conscious'' (275, 70.7%). Of these surgeons, 62.9% are willing to switch suture anchors brands to reduce overall costs if incentivized. Cost-conscious surgeons were more likely to be fellowship trained in shoulder and elbow (51.81% vs. 38.57%, $P = .048$), be paid based on productivity (73.53% vs. 61.43%, $P = .047$), and receive shared profits (85.4% vs. 75%, $P = .02$).

**Conclusion:** The majority of orthopedic surgeons are both cost-conscious and willing to change their practice to reduce costs if incentivized to do so. A better understanding of implant costs combined with incentives may help reduce health care expenditure.

**Level of evidence:** Survey Study; Experts



**Keywords:** Rotator cuff repair; cost awareness; survey; suture anchors; health care expenditure; implants

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The cost of health care in the United States has risen over the past several decades, and it currently accounts for 18% of the nation's gross domestic product and is expected to reach 20% by 2020.[5,12] Physicians have an important role in these expenses as they are responsible for approximately 60% to 80% of the decisions that result in health care expenditures.[1,33] Rising health care expenditures and the central role physicians hold make it essential for doctors to collaborate with health care administrators to reduce costs without compromising quality of care. Increasing physician cost consciousness, as a means to reduce wasteful practices among physicians, is increasingly being recognized as a way to reduce overall costs.[33]

A 2013 JAMA study reported that 36% of practicing physicians believe that they have a major responsibility to control health care costs.[32] The majority of physicians in that study felt that they only had some responsibility in controlling cost, showing that physicians potentially lack self-awareness of their ability to help control costs.[32] Despite the importance of decision making by physicians being a driver of health care costs, relatively little is known about orthopedic surgeons' attitudes toward cost-controlling variables. An important consideration in limiting costs is understanding the components of health care cost. In addition, it is important to understand how surgical implants may be reimbursed differently at different facilities (ie, hospital vs. ambulatory surgery center).[24]

Musculoskeletal conditions cause significant morbidity from chronic pain and loss of function and are the most common cause of disability in the United States, accounting for $576 billion, or 4.5% of the nation's GDP.[5] Shoulder conditions represent a notable portion of this with 8.2% of the US population reporting chronic shoulder pain.[5,23] Reflective of this, between 1996 and 2006, the volume of rotator cuff repairs increased by 141%,[9,22] accounting for an estimated $1.2 to $1.6 billion in US health care expenditures annually.[7] Studies regarding the cost of rotator cuff repair have evaluated several components of the surgery, concluding that the number and cost of suture anchors used are the main driver of rotator cuff repair cost.[4,7,10,22,31]

Relatively little is known about surgeons' attitudes toward cost control and variables associated with cost consciousness. The purpose of this study is to assess surgeons' cost awareness relative to the setting of rotator cuff repairs in relation to individual and practice demographics. Our hypothesis is that a surgeon's knowledge and attitudes toward surgical costs are related to their practice environment and training. A secondary hypothesis is that surgeons would be more willing to help reduce costs if a portion of the cost savings were shared.

## Materials and methods

### Study design

In this cross-sectional survey study, a 21-item survey created to examine physician knowledge of and perceived control over health care costs relative to rotator cuff repairs was distributed via the email list services of the American Shoulder and Elbow Surgeons and the Arthroscopy Association of North America memberships. Participation in the study was voluntary and no direct incentive was provided for completing it. Data were collected and managed using REDCap (Research Electronic Data Capture) tools.[13] REDCap is a secure, web-based application designed to support data capture for research studies.

### Survey instrument

Surgeon demographic- and practice-specific data were collected in the scope of rotator cuff repair. Demographic factors included age, sex, ethnicity, country of practice, income, amount of training, and type and location of practice. Survey items regarding the technical aspect of rotator cuff repair included single vs. double row, arthroscopic vs. open, number of rotator cuff repairs involving suture anchors performed per month, location of operations, and number of suture anchor companies used. The third portion of the survey looked at surgeons' knowledge of and attitude toward the economic factors involved with performing rotator cuff surgery. This included the mean cost of a suture anchor, reception of shared profits, hospital disclosure of a surgeon's rotator cuff repair cost, number of different brands of sutures used, knowledge of suture anchor cost, awareness of the percentage of all the health care expenditures directed by physicians, willingness to decrease cost, and willingness to modify one's own practice in order decrease cost. Multiple variables were collected to assess (1) surgeons' knowledge of costs relative to suture anchors and rotator cuff repairs, (2) whether or not they believe that they have control over costs relative to the procedure, and (3) if they are willing to change their practice to reduce costs.

### Statistical analysis

Descriptive statistics were calculated for the study sample and stratified by a physician being "cost-conscious" or "not cost-conscious." A physician was classified as cost-conscious if they answered "yes" to the question "Do you feel it is the surgeon's responsibility to consider costs, given equivalent quality outcomes?" A physician was classified as not cost-conscious if they responded to the same question with "maybe" or "no." This definition has been previously described and published in the medical literature.[6,11,18] These 2 groups were compared using Student's *t*-test for continuous variables and Pearson's $\chi^2$ test for categorical variables. *P* values less than .05 were considered statistically significant. Multivariable modeling was not possible due to the lack of significant associations on univariate analysis.

## Results

There were a total of 345 survey respondents from 23 countries, with the majority (89%) from the United States. Overall, 79.7% (275/345) of surgeon respondents were classified as "cost-conscious." Table I shows the demographic and training variables of participating physicians. There were no significant differences between the 2 cost consciousness groups based on age, sex, or race.

**Table I** Demographic and training characteristics of participating surgeons

| Variables | Total | Not cost-conscious | Cost-conscious | *P* value |
|---|---|---|---|---|
| Total participants (N) | 345 | 70 | 275 | – |
| Age groups (%) | | | | .39 |
| 30-34 | 5.5 | 4.3 | 5.8 | |
| 35-39 | 15.7 | 18.6 | 14.9 | |
| 40-44 | 19.4 | 15.7 | 20.4 | |
| 45-49 | 16.8 | 21.4 | 15.6 | |
| 50-54 | 11.0 | 15.7 | 9.8 | |
| 55-59 | 8.4 | 8.6 | 14.9 | |
| 60-64 | 7.5 | 4.3 | 9.5 | |
| 65-69 | 2.0 | 10.0 | 6.9 | |
| ≥70 | 2.0 | 1.4 | 2.2 | |
| Sex (%) | | | | .52 |
| Males | 95.6 | 94.2 | 96.0 | |
| Females | 4.4 | 5.8 | 4.0 | |
| Race (%) | | | | .76 |
| White | 85.3 | 88.6 | 84.7 | |
| Black or African American | 0.6 | 1.4 | 0.4 | |
| Asian | 5.8 | 4.3 | 6.2 | |
| Hispanic or Latino | 5.2 | 4.3 | 5.1 | |
| Native American | 0.6 | 0 | 0.7 | |
| Other | 2.6 | 1.4 | 2.9 | |
| Fellowship trained (%) | 92.9 | 93.0 | 92.9 | .98 |
| Arthroplasty/joints | 3.5 | 3.6 | 2.9 | .75 |
| Foot and ankle | 0.9 | 1.4 | 0.7 | .57 |
| Hand | 2.9 | 1.4 | 3.3 | .41 |
| Pediatrics | 0 | 0 | 0 | – |
| Shoulder and elbow | 49.1 | 38.6 | 51.8 | .048 |
| Spine | 0 | 0 | 0 | – |
| Sports | 46.5 | 51.4 | 45.3 | .36 |
| Trauma | 0.6 | 0 | 0.7 | .48 |
| Tumor | 0 | 0 | 0 | – |

Cost-conscious surgeons, compared with their not cost-conscious counterparts, were more likely to be fellowship trained in shoulder and elbow (51.81% vs. 38.57%, $P = .048$), be paid on a productivity base as opposed to salary (73.53% vs. 61.43%, $P = .047$), and receive shared profits (85.4% vs. 75%, $P = .02$). Regarding the work setting, the cost-conscious group was less likely to be a hospital employee ($P = .003$), work in solo practice ($P = .0005$), or work at the Veterans Affairs hospital ($P = .006$) and more likely to work in a small private practice group ($P = .002$). Of the cost-conscious group, 75% worked in a private setting. Of the not cost-conscious group, 58.7% worked in a private setting.

There were no significant differences between the cost-conscious and not cost-conscious groups based on volume of rotator cuff repairs, single vs. double row technique, or the number of companies providing suture anchors. Cost-conscious surgeons were more likely to consider changing implants to decrease cost (89.4% vs. 61.3%, $P = .0001$) and more likely to have moderate, great, or extreme concern of cost (91.0% vs. 64.3%, $P = .001$). The cost-conscious surgeons reported being more likely to change their practice (ie, selection of implants and other disposables) if incentivized, although this did not reach significance (27.2% vs. 10.1%, $P = .052$). Overall, 62.9% of all respondents would change practice patterns if incentives were provided, whereas 19.7% were indifferent, and only 17.4% would not change. Differences were seen between the 2 groups regarding the estimated cost of a suture anchor. Physicians who were classified as not cost-conscious estimated the cost of a suture-anchor to be $399, whereas the cost-conscious respondents estimated the cost to be $342 ($P = .259$). Table II shows the practice characteristics, attitudes toward cost, and cost practices of the participating surgeons.

The most common surgical settings were outpatient surgical centers (59.8%), private hospitals (58.4%), and academic medical centers (31.8%). There were no significant differences in any of the aforementioned variables by physician cost consciousness with exception to outpatient surgery center where the highest percentage of cost-conscious surgeons were identified (62.7% cost-conscious vs. 48.6% not cost-conscious, $P = .032$). At this location, surgeons reported the highest profit share percentage at

**Table II** Practice characteristics and cost attitudes/practices of participating surgeons

| Variables | Total | Not cost-conscious | Cost-conscious | *P* value |
|---|---|---|---|---|
| Type of payment (%) | | | | .047 |
| Salary | 29.0 | 38.6 | 26.5 | |
| Productivity based | 71.1 | 61.4 | 73.5 | |
| Number of RCR/mo (%) | | | | .55 |
| 1-3 | 9.6 | 12.9 | 8.8 | |
| 4-6 | 17.2 | 17.1 | 17.2 | |
| 7-9 | 21.9 | 27.1 | 20.5 | |
| 10-14 | 23.3 | 21.4 | 23.8 | |
| 15-19 | 17.2 | 11.4 | 18.7 | |
| ≥20 | 10.8 | 10.0 | 11.0 | |
| RCR technique (%) | | | | .41 |
| Single row | 33.0 | 37.1 | 32.0 | |
| Double row | 67.0 | 62.9 | 68.0 | |
| Estimated cost of suture anchor (USD) | | 321 | 372 | .259 |
| Type of practice (%) | | | | |
| Private university employee | 9.3 | 12.9 | 8.3 | .24 |
| Public university employee | 11.3 | 15.7 | 10.1 | .19 |
| Hospital employee | 17.9 | 30.0 | 14.9 | .003 |
| Large private academic group (>25 surgeons) | 7.8 | 5.7 | 8.3 | .47 |
| Small private academic group (<25 surgeons) | 6.9 | 4.3 | 7.6 | .33 |
| Large private practice group | 12.4 | 5.7 | 14.1 | .056 |
| Small/medium private practice group | 22.3 | 8.6 | 25.7 | .002 |
| Large multispecialty group | 7.5 | 10.0 | 6.9 | .38 |
| Small/medium multispecialty group | 0.9 | 0.0 | 1.1 | .38 |
| Solo practice | 9.3 | 20.0 | 6.5 | .0005 |
| Veterans affairs | 1.2 | 4.3 | 0.4 | .006 |
| Military | 0.9 | 1.4 | 0.7 | .57 |
| Number of companies providing suture anchors (%) | | | | .44 |
| 1 | 56.7 | 65.7 | 54.4 | |
| 2 | 36.0 | 27.1 | 38.2 | |
| 3 | 6.1 | 5.7 | 6.3 | |
| 4 | 0.9 | 1.4 | 0.7 | |
| >4 | 0.3 | 0.0 | 0.4 | |
| Concern of cost (%) | | | | .001 |
| No concern | 1.2 | 1.4 | 1.1 | |
| Little concern | 13.3 | 34.3 | 8.0 | |
| Moderate concern | 54.9 | 51.4 | 55.8 | |
| Great concern | 25.1 | 10 | 29.0 | |
| Extreme concern | 5.5 | 2.9 | 6.2 | |
| Surgeons willingness to change implants to decrease cost (%) | | | | .0001 |
| Yes | 65.6 | 61.3 | 89.4 | |
| No | 34.4 | 38.7 | 10.6 | |
| Decrease cost if incentivized (%) | | | | .0522 |
| Strongly disagree | 9.5 | 11.6 | 9.1 | |
| Moderately disagree | 7.8 | 8.7 | 7.6 | |
| Neutral/indifferent | 19.7 | 26.1 | 18.1 | |
| Moderately agree | 39.0 | 43.5 | 38.0 | |
| Strongly agree | 24.0 | 10.1 | 27.2 | |
| Consultant (%) | | | | .45 |
| No | 81.2 | 84.3 | 80.4 | |
| Yes | 18.8 | 15.7 | 19.6 | |

*RCR*, rotator cuff repair.

**Table III** Characteristics of surgical setting and payment models for participating surgeons

| Variables | Total | Not cost-conscious | Cost-conscious | *P* value |
|---|---|---|---|---|
| Surgical setting (%) | | | | |
| Cost disclosure at any location (%) | 52.6 | 51.1 | 58.6 | .26 |
| Academic medical center | 31.8 | 37.1 | 30.4 | .28 |
| Profit share (%) | 1.5 | 0.0 | 1.8 | .52 |
| Cost disclosure (%) | 7.5 | 5.7 | 8.0 | .836 |
| Disclosure frequency (%) | | | | .81 |
| Monthly | 12.5 | 25 | 10 | |
| Quarterly | 20.8 | 25 | 20 | |
| Biannually | 4.2 | 0 | 5 | |
| Annually | 62.5 | 50 | 65 | |
| Cost position (%) | | | | .41 |
| I don't know | 13.0 | 16 | 12.1 | |
| Extremely above average | 0.9 | 4 | 0 | |
| Above average | 26.9 | 32 | 25.3 | |
| Average | 34.3 | 32 | 34.9 | |
| Below average | 20.4 | 12 | 22.9 | |
| Extremely below average | 4.6 | 4 | 4.8 | |
| Outpatient surgery center | 59.8 | 48.6 | 62.7 | .032 |
| Profit share | 38.4 | 27.1 | 41.3 | .029 |
| Cost disclosure | 35.6 | 30.0 | 37.0 | .28 |
| Disclosure frequency (%) | | | | .66 |
| Monthly | 12.2 | 14.3 | 11.8 | |
| Quarterly | 32.5 | 33.3 | 32.4 | |
| Biannually | 13.0 | 4.8 | 14.7 | |
| Annually | 42.3 | 47.6 | 41.2 | |
| Cost position (%) | | | | .03 |
| I don't know | 9.7 | 20.6 | 7.6 | |
| Extremely above average | 0.5 | 2.9 | 0 | |
| Above average | 16.0 | 17.7 | 15.7 | |
| Average | 39.3 | 38.2 | 39.5 | |
| Below average | 27.7 | 14.7 | 30.2 | |
| Extremely below average | 6.8 | 5.9 | 7.0 | |
| Private hospital | 58.4 | 58.6 | 58.3 | .97 |
| Profit share | 6.6 | 4.3 | 7.3 | .37 |
| Cost disclosure | 9.8 | 10.0 | 9.8 | .96 |
| Disclosure frequency (%) | | | | .37 |
| Monthly | 23.5 | 28.6 | 22.2 | |
| Quarterly | 11.8 | 28.6 | 7.4 | |
| Biannually | 5.9 | 0 | 7.4 | |
| Annually | 58.8 | 42.9 | 63.0 | |
| Cost position (%) | | | | .13 |
| I don't know | 16.9 | 29.3 | 13.8 | |
| Extremely above average | 1.0 | 2.4 | 0.6 | |
| Above average | 19.4 | 22.0 | 18.8 | |
| Average | 38.8 | 31.7 | 40.6 | |
| Below average | 18.4 | 12.2 | 20.0 | |
| Extremely below average | 16.9 | 2.4 | 6.3 | |
| Veterans affairs | 2.0 | 5.7 | 1.1 | .014 |
| Profit share | 0 | 0 | 0 | – |
| Cost disclosure | 0 | 0 | 0 | – |
| Cost position (%) | | | | .23 |
| I don't know | 14.3 | 0 | 33.3 | |
| Above average | 28.6 | 50 | 0 | |
| Average | 42.9 | 25 | 66.7 | |
| Below average | 14.3 | 25 | 0 | |

(*continued on next page*)

**Table III** Characteristics of surgical setting and payment models for participating surgeons (*continued*)

| Variables | Total | Not cost-conscious | Cost-conscious | *P* value |
|---|---|---|---|---|
| Military hospital | 0.9 | 1.4 | 0.7 | .57 |
| Profit share | 0.3 | 0 | 0.4 | .614 |
| Cost disclosure | 0 | 0 | 0 | – |
| Cost position (%) | | | | .22 |
| I don't know | 33.3 | 0 | 50 | |
| Above average | 33.3 | 0 | 50 | |
| Average | 33.3 | 100 | 0 | |

41.3% between the cost-conscious surgeons and only 27.1% of the not cost-conscious had profit share ($P = .029$). Table III summarizes the profit share percentage, percentage of cost disclosure, frequency of cost disclosure, and cost position of the physician relative to their colleagues stratified by surgical setting (ie, academic medical center, outpatient surgical center, private hospital, veteran affairs hospital, military hospital, or other).

As the different medical payment systems of international respondents may affect the description of cost consciousness, an analysis was conducted, and the results are reported in Tables IV and V. There were no changes in demographic results, so a separate table was not created to reflect the comparisons in Table I. The majority of relationships remained the same. Type of payment ($P = .19$) and outpatient surgery center profit share ($P = .055$) and cost position ($P = .082$) no longer significantly affected cost consciousness. Being in a large private practice group ($P = .015$) and academic medical center cost disclosure ($P = .048$) showed a significant impact on cost consciousness with these analyses.

## Discussion

Rotator cuff repair is one of the most commonly performed procedures. Over 250,000 are performed annually, accounting for over a billion dollars in US health care costs each year. Targeting and reducing costs of rotator cuff repair could reduce overall health care expenditures by as much as an estimated $80-$262 million per year.[4,7,9,21,31] The results of this survey to the Arthroscopy Association of North America and American Shoulder and Elbow Surgeons members suggest that surgeons are more willing to change their practice patterns to reduce surgical costs if they are incentivized to do so. There appears to be a few differences in the incentivization behaviors between US and international surgeons.

This study was conducted with the aim to assess surgeons' knowledge of and attitude toward surgical costs in regard to suture anchors used in rotator cuff repairs. Surgeon and practice characteristics and variables involved in rotator cuff repair have been described in relation to cost consciousness. A principal finding from the survey results demonstrates that over 60% of surgeons are willing to switch suture anchors to reduce overall costs if they are incentivized. These findings may have financial and practical implications for reducing costs relative to rotator cuff repairs and, subsequently, health care costs as a whole. Between United States and international respondents, several differences were found, and although these may be attributed to the low response rate, the type of training, reimbursement, and governmental oversight in countries outside of the United States should be considered.

An important means of understanding costs of rotator cuff repair is evaluation of the components of overall costs. There have been relatively few studies analyzing the components of the cost of rotator cuff repairs. Existing studies have identified the cost and number of suture anchors used as the main driver of cost. Narvy et al[22] cited the mean anchor cost to be $3432.67 while the mean anchor cost per case out of $5904.21 total estimated cost (58.1%), making suture anchor cost per procedure the majority of the overall cost. These findings were supported by a study by Tashjian et al,[31] which found that the total number of suture anchors used and total implant costs were the main driver of the overall cost. A recent study by Chalmers et al[7] quantified this further by showing that the use of 3, 4, 5, or 6 anchors increased the total direct cost by 41%, 82%, 97%, and over 2-fold, respectively. There is additional cost in terms of the increasing operative time needed to place additional implants.

The additional cost incurred by each suture anchor is 2-fold: first, it adds the cost of the implant itself, and furthermore, it increases operative time due to the time to implant, pass, and tie suture. Knotless anchors add to the cost of the implant as well as the time needed to thread the bridge sutures and implant the anchor.[4,10] In the retrospective study by Chalmers et al,[7] outcomes were not associated with the number of anchors. In other words, more anchors directly correlated with increased costs but had no effect on clinical outcomes, therefore decreasing the value. Black et al[5] explain that the value of a procedure involves the relationship between clinical benefit and potential cost. The findings in this study suggest that surgeons may provide higher value–based health care by decreasing costs without affecting outcome if incentivized, which will ultimately help the health care system as a whole.

**Table IV** Practice characteristics and cost attitudes/practices of participating surgeons

| Variables | Total | Not cost-conscious | Cost-conscious | *P* value |
|---|---|---|---|---|
| Type of payment (%) | | | | .19 |
| Salary | 28.5 | 36.2 | 26.7 | |
| Productivity based | 71.5 | 63.8 | 73.3 | |
| Number of RCR/mo (%) | | | | .69 |
| 1-3 | 9.0 | 10.3 | 8.7 | |
| 4-6 | 17.7 | 19.0 | 17.4 | |
| 7-9 | 23.1 | 20.3 | 21.6 | |
| 10-14 | 23.4 | 22.4 | 23.7 | |
| 15-19 | 17.4 | 12.1 | 18.7 | |
| ≥20 | 9.4 | 6.9 | 10.0 | |
| RCR technique (%) | | | | 1.0 |
| Single row | 32.1 | 32.8 | 32.0 | |
| Double row | 67.2 | 67.2 | 68.1 | |
| Estimated cost of suture anchor (USD) | | | | |
| Type of practice (%) | | | | |
| Private university employee | 7.6 | 6.9 | 7.8 | 1.0 |
| Public university employee | 9.3 | 15.5 | 7.8 | .080 |
| Hospital employee | 16.6 | 27.6 | 14.0 | .018 |
| Large private academic group (>25 surgeons) | 7.6 | 5.2 | 8.2 | .59 |
| Small private academic group (<25 surgeons) | 6.3 | 3.5 | 7.0 | .55 |
| Large private practice group | 13.0 | 3.5 | 15.2 | .015 |
| Small/medium private practice group | 22.9 | 8.6 | 26.3 | .0029 |
| Large multispecialty group | 8.3 | 12.1 | 7.4 | .29 |
| Small/medium multispecialty group | 1.0 | 0 | 1.2 | 1.0 |
| Solo practice | 8.0 | 19.0 | 5.4 | .0018 |
| Veterans affairs | 1.3 | 5.2 | 0.4 | .024 |
| Military | 1.0 | 1.7 | 0.8 | .48 |
| Number of companies providing suture anchors (%) | | | | .065 |
| 1 | | 74.1 | 56.0 | |
| 2 | | 20.7 | 37.3 | |
| 3 | | 3.5 | 5.8 | |
| 4 | | 1.7 | 0.8 | |
| >4 | | 0 | 0 | |
| Concern of cost (%) | | | | <.0001 |
| No concern | 0.3 | 1.7 | 0 | |
| Little concern | 13.0 | 34.5 | 7.8 | |
| Moderate concern | 57.5 | 53.5 | 58.4 | |
| Great concern | 23.6 | 8.6 | 27.2 | |
| Extreme concern | 5.6 | 1.7 | 6.6 | |
| Surgeons willingness to change implants to decrease cost (%) | | | | <.0001 |
| Yes | 66.4 | 34.5 | 74.1 | |
| No | 33.6 | 65.5 | 25.9 | |
| Decrease cost if incentivized (%) | | | | .15 |
| Strongly disagree | 10.0 | 10.3 | 9.9 | |
| Moderately disagree | 7.3 | 8.6 | 7.0 | |
| Neutral/indifferent | 20.6 | 25.9 | 19.3 | |
| Moderately agree | 39.2 | 44.8 | 37.9 | |
| Strongly agree | 22.9 | 10.3 | 25.9 | |
| Consultant (%) | | | | |
| No | 82.1 | 86.2 | 81.1 | .36 |
| Yes | 17.9 | 13.8 | 18.9 | |

*RCR*, rotator cuff repair.

**Table V** Characteristics of surgical setting and payment models for participating surgeons

| Variables | Total | Not cost-conscious | Cost-conscious | *P* value |
|---|---|---|---|---|
| Surgical setting (%) | | | | |
| Cost disclosure at any location (%) | | | | |
| Academic medical center | 28.9 | 32.8 | 28.0 | .52 |
| Profit share (%) | 1.3 | 0 | 1.7 | 1.0 |
| Cost disclosure (%) | 5.3 | 0 | 6.6 | .048 |
| Disclosure frequency (%) | | | | – |
| Monthly | 6.7 | 0 | 6.7 | |
| Quarterly | 26.7 | 0 | 26.7 | |
| Biannually | 6.7 | 0 | 6.7 | |
| Annually | 60.0 | 0 | 60.0 | |
| Cost position (%) | | | | .47 |
| I don't know | 12.8 | 15.8 | 11.9 | |
| Extremely above average | 0 | 0 | 0 | |
| Above average | 24.4 | 31.6 | 22.4 | |
| Average | 36.0 | 42.1 | 34.3 | |
| Below average | 22.1 | 10.5 | 25.4 | |
| Extremely below average | 4.7 | 0 | 6.0 | |
| Outpatient surgery center | 65.8 | 53.5 | 68.7 | .032 |
| Profit share | 42.9 | 31.0 | 45.7 | .055 |
| Cost disclosure | 39.9 | 32.8 | 41.6 | .24 |
| Disclosure frequency (%) | | | | .67 |
| Monthly | 11.7 | 15.8 | 10.9 | |
| Quarterly | 32.5 | 31.6 | 32.7 | |
| Biannually | 13.3 | 5.3 | 14.9 | |
| Annually | 42.5 | 47.4 | 41.6 | |
| Cost position (%) | | | | .082 |
| I don't know | 10.1 | 22.6 | 7.8 | |
| Extremely above average | 0 | 0 | 0 | |
| Above average | 14.7 | 16.1 | 14.5 | |
| Average | 40.1 | 41.9 | 39.8 | |
| Below average | 28.4 | 16.1 | 30.7 | |
| Extremely below average | 6.6 | 3.2 | 7.2 | |
| Private hospital | 58.1 | 56.9 | 58.4 | .88 |
| Profit share | 5.3 | 1.7 | 6.2 | .32 |
| Cost disclosure | 8.3 | 6.9 | 8.6 | .80 |
| Disclosure frequency (%) | | | | .48 |
| Monthly | 16.0 | 25.0 | 14.3 | |
| Quarterly | 8.0 | 25.0 | 4.8 | |
| Biannually | 4.0 | 0 | 4.8 | |
| Annually | 72.0 | 50.0 | 76.2 | |
| Cost position (%) | | | | .087 |
| I don't know | 17.8 | 33.3 | 14.2 | |
| Extremely above average | 0.6 | 0 | 0.7 | |
| Above average | 19.0 | 21.2 | 18.4 | |
| Average | 40.2 | 36.4 | 41.1 | |
| Below average | 17.8 | 9.1 | 19.9 | |
| Extremely below average | 4.6 | 0 | 5.7 | |
| Veterans affairs | 2.3 | 6.9 | 1.2 | .028 |
| Profit share | 0 | 0 | 0 | – |
| Cost disclosure | 0 | 0 | 0 | – |
| Cost position (%) | | | | .23 |
| I don't know | 14.3 | 0 | 33.3 | |
| Above average | 28.6 | 50.0 | 0 | |
| Average | 42.9 | 25.0 | 66.7 | |
| Below average | 14.3 | 25.0 | 0 | |

(*continued on next page*)

**Table V** Characteristics of surgical setting and payment models for participating surgeons (*continued*)

| Variables | Total | Not cost-conscious | Cost-conscious | *P* value |
|---|---|---|---|---|
| Military hospital | 1.0 | 1.7 | 0.8 | .48 |
| Profit share | 0 | 0 | 0 | – |
| Cost disclosure | 0 | 0 | 0 | – |
| Cost position (%) | | | | .22 |
| I don't know | 33.3 | 0 | 50.0 | |
| Above average | 33.3 | 0 | 50.0 | |
| Average | 33.3 | 100.0 | 0 | |

The effects of incentivization, although suggested as beneficial by the results of this study, are in actuality complex.[11] Incentives result in 2 effects, an extrinsic (eg, monetary) and a psychological. Extrinsic motivation in the short term leads to greater effort and improved performance as there is direct gain. This may provide initial motivation for developing long-term cost-effective practices. However, extrinsic incentives can also lead to unintended negative consequences, especially in the psychological aspect. For example, providing extrinsic incentives may signal that a specific task or goal is difficult or not attractive and therefore needing incentivization. Greater personal benefit from a task may cause lower reputational value as it is less altruistic. Therefore, when considering incentivization in the context of suture anchor practices for reducing cost, attention needs to be given to all aspects of its effects.

Physician control of health care resources is an important component of overall cost physicians influence the majority of health care expenditures.[1,33] This study focused on suture anchors as the existing literature has identified that cost and number of suture anchors used are the main driver of cost in rotator repairs. We considered this to be a variable that the surgeon likely has a significant degree of control over. However, several studies have shown that physicians have limited knowledge of implant and operating room supply costs.[3,16,26,29,30] Okike et al[24] found that orthopedic surgeons estimated the correct cost of implants only 21% of the time and residents 17% of the time. In addition, 80% of respondents in that study responded that cost should be "moderately," "very," or "extremely" important in the device selection process.[24] This is of significant importance to overall expenditures because implant cost has been shown to represent as much as 87% of orthopedic procedure costs,[28] whereas it is estimated that waste accounts for as much as 30% of overall health care costs.[1] Thus, the potential limitations in surgeons' knowledge of implant costs are important because of the crucial role they can have in the allocation, use, and cost of consumable resources such as suture anchors. Hospital systems should share this information with their surgeons to increase awareness. A cost survey by Tilburt et al[32] showed that 85% of physicians agreed that "trying to contain costs is the responsibility of every physician." There is little evidence supporting the use of one implant over another despite wide variation in cost.[28] Furthermore, prior research has shown that choosing less expensive implants can reduce overall costs without compromising quality of care.[8,19,24,25,34] A barrier to cost-saving interventions is that implant costs have wide variability by institution, and pricing contracts with suppliers are confidential.[24,27,28] Okike et al concluded that "most orthopedic surgeons have no incentive to learn the costs of the devices they use, because those costs do not directly affect the care they provide or their own reimbursement."[14,24] Given the enormous burden of musculoskeletal disease, the high cost of implants relative to orthopedic procedures, and physicians' control over implant choice and usage, knowledge of and reduction of these costs could have significant effects on overall health care expenditures. Alignment between surgeons, hospital administration, and implant companies could lead to lower costs to the health care system.

This study was limited to associations of cost consciousness and surgeons' willingness to change if incentivized. However, a study by Avansino et al[2] showed that pediatric surgeons who implemented a standardized preference card for appendectomies resulted in a 20% decrease in the cost of surgical supplies per case. This resulted in annual savings of greater than $41,000 with an average of $167 saved per case.[2,26] Other hospitals have incentivized cost-saving practices by physicians by providing research funding, new equipment, and financial support for overhead payments for those who have generated cost savings.[15,17,20,24]

This study has several notable limitations. Some of the comparisons trended toward but did not reach significance, which is likely due to the limited sample size of 345 surgeons across the world. Because of the nature of a cross-sectional study, we can only comment on associations regarding cost consciousness. We cannot determine the cause or motive. There is an inherent selection and nonresponse bias as it is possible that many of those who completed the survey did so due to an interest in the topic or previous exposure to cost-consciousness studies. In addition, knotless suture anchor techniques can theoretically decrease operative times, but the cost-benefit ratio of this is outside the scope of this study. Cost consciousness was defined by 1 question in this study instead of the full

scale described in the literature. This may result in an incomplete evaluation of cost consciousness.

## Conclusion

Our study is the first to assess cost consciousness of orthopedic surgeons within the setting of rotator cuff repairs. Factors that are associated with cost consciousness include being fellowship trained in shoulder and elbow, a hospital employee, and in a small/medium private practice, solo, or outpatient surgery center practice, and have a productivity-based payment system. Our study suggests that the majority of orthopedic surgeons are both cost-conscious and may be willing to change their practice to reduce costs if incentivized to do so. This suggests that a better understanding of implant costs combined with incentives to lower cost may lead to substantial reductions in health care expenditures for rotator cuff repairs.

## Disclaimer

Brent Ponce has stock/stock options with Help Lightning, is a paid consultant/presenter/speaker for Tornier, and has IP royalties with Wright Medical Technology, Inc. Wesley Phipatanakul is a board/committee member of the American Academy of Orthopaedic Surgeons and American Shoulder and Elbow Surgeons and is a consultant/presenter/speaker for Arthrex, Inc. John Tokish is a paid consultant/presenter/speaker for Arthrex, Inc. and Mitek, is a board/committee member for the Arthroscopy Association of North America, is a paid consultant for DePuy, A Johnson & Johnson Company, is on the editorial/governing board with royalties/financial/material support of the *Journal of Shoulder and Elbow Surgery*, and is on the editorial/governing board for *Orthopedics Today*. All the other authors, their immediate family, and any research foundation, with which they are affiliated, did not receive any financial payments or other benefits from any commercial entity related to the subject of this article.

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