

Surgical Equipment Price Awareness Amongst Obstetrician-Gynecologists

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ABSTRACT

Background and Objectives: Physicians typically have little information of surgical device pricing, although this trend has not been studied in the field of obstetrics and gynecology. We therefore aimed to determine how accurately obstetrician-gynecologists estimate surgical device prices, and to identify factors associated with accuracy.

Methods: An anonymous survey was emailed to all obstetrician-gynecologist attendings, fellows, and residents at 3 teaching hospitals in a single healthcare system in Arizona. We obtained demographic data, perceptions of price transparency and self-rated price knowledge, and price estimates for 31 surgical devices.

Results: After participants provided consent and demographics, they then estimated the purchasing price of 31 devices. We defined price accuracy as being within $\pm 10\%$ of the hospital's purchasing price. Fifty-six of the 170 (32.9%) invitees completed the survey and 48 (28.2%) provided price estimates. On average, participants identified 1.9 items correctly (6.1%; range, 0–7 items) out of 31 with no difference in accuracy based on seniority, surgical volume, physician reimbursement structure, nor subspecialty practice-focus. All (100%) respondents felt pricing should be transparent, and only 1.8% felt it is at least somewhat transparent.

Conclusion: We found that price-estimate accuracy was

very low and had no association with any of the demographics. Also notable was the perception that pricing is not transparent despite a unanimous desire for transparency. Although physicians reported a preference for using less-expensive surgical devices, we conclude that physicians are unequipped to make cost-conscious decisions highlighting a large potential for education.

Key Words: Cost; Education; Price; Surgery; Transparency.

INTRODUCTION

The United States has the highest health care costs of any industrialized nation, accounting for 17.9% of its gross domestic product in 2016.¹ This spending is concerning nationally and directly impacts our patients because medical debt is the most common reason for filing bankruptcy.² Surgeons directly affect health care delivery costs by choosing which surgical devices to utilize. Unfortunately, physicians typically have low levels of awareness and information on device prices.³

Device pricing is an intricate system. Nondisclosure contracts frequently exist between purchasers and sellers which forbid price transparency to other parties. Hospitals may have relationships with group purchasing organizations who control their supply purchasing and sell market shares to device and pharmaceutical companies.⁴ Other factors include loss of bargaining power by device companies if list prices are widely disclosed, hesitation by vendors to publicly disclose list prices for fear of reprimand by their employers, bundled package deals, or conflicts of interest amongst various competing businesses and governing bodies.

In efforts to make cost-conscious decisions in the operating room, we found it difficult to determine device prices and noted a similar trend amongst other physicians. There is scant literature addressing device price-estimate accuracy by obstetrician-gynecologists. We therefore conducted a pilot study to objectively establish a baseline accuracy at our institution where purchasing price is uniform. Our primary objective was to establish how accu-

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Informed consent: Dr. Steck-Bayat declares that written informed consent was obtained from the patient/s for publication of this study/report and any accompanying images.

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rately our physicians estimated device prices, and secondarily to assess associated factors and attitudes towards price transparency.

MATERIALS AND METHODS

An anonymous survey was distributed by e-mail to all obstetrician-gynecologists and related subspecialists on staff at three teaching institutions in the same health care system (Banner University Medical Centers,–Phoenix, Tucson, and South Arizona). Data were collected through Qualtrics (Provo, Utah; and Seattle, Washington) on a Protected Health Information Secure University of Arizona cloud platform. The University of Arizona Institutional Review Board approved this study (#1801190984 on January 29, 2018).

Upon opening the link on a mobile device or computer, a disclosure statement was displayed and informed consent was obtained. The second survey page then prompted basic demographics, surgical volume, level of training including prior fellowship training, practice focus, reimbursement structure, prior knowledge or education about device pricing, and undergraduate degree. On a 5-point Likert scale, we assessed if the participant felt surgical device pricing is transparent, their self-rating on price knowledge, and the importance they place on price in selecting which devices to use in their cases. On a 7-point Likert scale, we assessed if they feel pricing should be transparent and their personal interest in the business of medicine.

Lastly, photos were displayed of specific devices along with the manufacturer and device name. The 31 devices

were specifically chosen to reflect a wide range of prices (from \$1.74 to \$1,465.00), items that were deemed to be commonly used by obstetrician-gynecologists in various subspecialties, and multiple categories of devices (trocars, vascular clips, accessories, bipolar devices, hemostatic agents). Respondents were asked to type an estimate of our healthcare system’s purchasing price to the nearest whole dollar in a free-text entry box (**Figure 1**). In random order, these same 31 items were displayed to all participants with instructions to leave the question blank, type 0, or n/a if they felt unfamiliar with the item to avoid random guesses. We defined estimation accuracy as being within $\pm 10\%$ of our institution’s purchasing price.

A total of 3 subsequent e-mails were sent weekly to the physicians who had not yet completed the survey. The survey was open for a total of 4 weeks and could be completed in multiple sessions by the respondent via their unique survey link.

Information collected through Qualtrics (Provo, Utah and Seattle, Washington) was downloaded and imported into SAS (Cary, NC) version 9.4 for summary and analysis. Categorical differences in characteristics were assessed with the likelihood ratio test for small sample sizes. Differences in means and variance were assessed using non-parametric analyses for the skewed distribution of item price analyses. One-way analysis of variance (ANOVA) was used to assess differences by training status, years in practice, fellowship completion if applicable, reimbursement structure, and surgical specialty categories although



Figure 1. Example of survey prompt for price estimate in the survey.

no significant differences were found. As only four respondents reported ‘above average’ or ‘excellent’ knowledge of surgical device pricing, the four category (above average/excellent, average, below average, poor) and three category (average knowledge or greater, below average, and poor), variables were created to assess price estimation differences by self-reported pricing knowledge. The standard a priori level of 0.05 was used as an indicator of significance.

We did not perform a power calculation before the pilot study because our target population was fixed. However, our post-hoc calculation of the final 48 participants who provided price estimates was powered at 86% to detect a ±10% difference (two-sided test).

RESULTS

Of the 175 e-mail addresses, 5 were excluded for duplicates or being involved in the study design. Of the remaining 170 invitees, 56 completed the survey (32.9%) and 48 provided price estimates (28.2%). Eight participants completed demographic information but provided no price estimates for unknown reasons. The demographics analysis was performed on the 56 participants, and the price estimate calculations were performed on the 48 participants. Of note, 3 clearly erroneously entered price estimates (\$3,002,000, \$1,001,000, \$400,150) by a single participant were removed from the analysis.

Of the physicians who responded to the survey, 44.6% were attendings and 55.4% were residents or fellows. Of the attendings, the median time since graduation was 19.5 ± 12.9 years (range, 2–43 years). Forty-three percent were male (n = 24) and 57% (n = 32) were female. Fifty-five percent (n = 31) were 25–34 years of age, 12.5% (n = 7) were 35–44 years of age, 14% (n = 8) were 45–54 years of age, and the remaining 17.9% (n = 10) were older than 54 years of age. Sixty-seven percent (n = 36) identified their practice as general OB/GYN, 7.4% (n = 4) as Gyn-Oncology, 3.7% (n = 2) as Minimally Invasive GYN Surgery, 7.4% (n = 4) as Reproductive Endocrinology and Infertility, and the remaining 9.3% (n = 5) as either Urogynecology, Maternal-Fetal-Medicine, Laborist, or other. Sixty percent (n = 33) were flat salary, 20.0% (n = 11) salary plus incentives, 16.4% (n = 9) private practice, and 3.6% (n = 2) other (**Table 1**). Median surgical volume was 30 major cases per year (mean, 52.6 ± 83.5; range, 0–525) and a median 50 minor cases per year (mean, 56.3 ± 42.4; range, 0–200; **Figure 2**).

One hundred percent (n = 56) of respondents felt that pricing should be transparent to physicians, but only 1.8%

	Responses, n	Percent
Gender		
Female	32	57
Male	24	43
Age, years		
25–34	31	55
35–44	7	12.5
45–54	8	14
55 or older	10	17.9
Practice type		
General OB/GYN	36	67
Gyn-oncology	4	7.4
MIGS	4	7.4
REI	4	7.4
FPMRS, MFM, Laborist, or other	5	9.3
Reimbursement structure		
Flat salary	33	60
Salary plus incentives	11	20
Private practice	9	16.4
Other	2	3.6
Training status		
Attending	25	44.6
Resident or fellow	30	55.4

FPMRS, Female Pelvic Medicine & Reconstructive Surgery; MFM, Maternal-Fetal Medicine; MIGS, Minimally Invasive GYN Surgery; OB/GYN, Obstetrics & Gynecology; REI, Reproductive Endocrinology & Infertility.

(n = 1) felt that pricing is currently transparent. On a 5-point Likert scale, self-rated knowledge of surgical device pricing at our institution was below average or poor for 70% (n = 39), average for 23% (n = 13), and above average or excellent for 7.2% (n = 4). On a 7-point Likert scale, 82% (n = 46) somewhat agree, agree, or strongly agree that they are interested in the business of medicine. When asked if the efficiency of an instrument is preferred over the price, 89% (n = 50) somewhat agree, agree, or strongly agree. Sixty-four percent (n = 36) somewhat agree, agree, or definitely agree that price affects which devices they choose to utilize in surgery (**Table 2**).

Among all participants, on average the percentage of items estimated accurately was 6.1% (1.9 items out of 31) with a range of 0%–22.6% (0–7 items out of 31). No

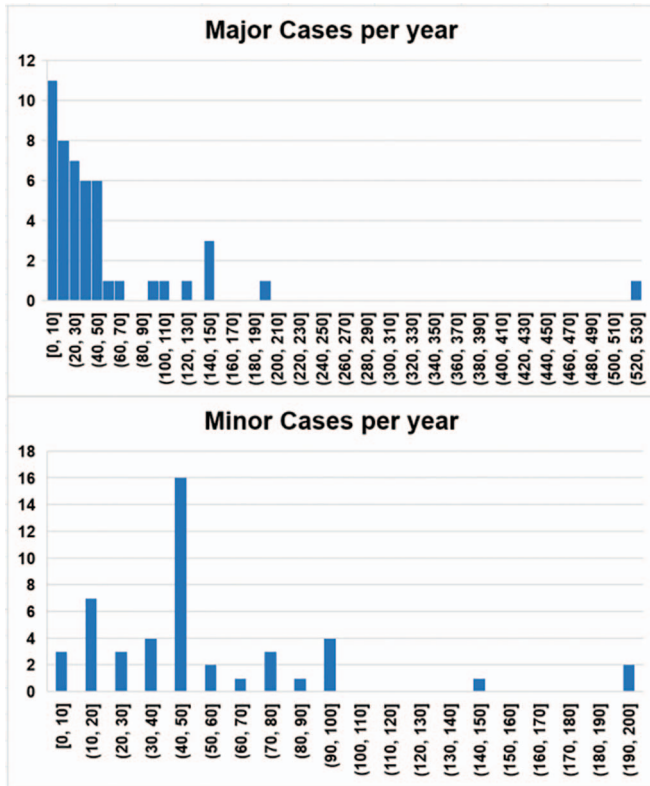


Figure 2. Distribution of major and minor surgeries per year by respondents. Major: hysterectomy, myomectomy, pelvic suspension, etc. Minor: hysteroscopy, diagnostic laparoscopy, tubal ligations. X-axis: surgeries per year. Y-axis: number of responses per surgery volume range.

participant could accurately estimate the price of 7 specific items. For 26 of 31 specific items (83.9%), 90% or greater of the participants were inaccurate. Of the 5 items with >10% participants accurately estimating, the mean accuracy was still low at 16.1% of participants correct (range, 12.5%–17.9%). The two items most frequently estimated accurately (both at 17.9%) were a 5-mm × 37-cm bipolar vessel sealer and a hyaluronic acid based adhesion barrier (**Table 3**).

When looking at all participant estimates for all items compared to actual price, the mean was more than double the actual price at 229.3%. The range was very wide from 2.7%–10,000% with a standard deviation 436.1% and median of 103.4%. When looking at the average estimates by the cohort for each item as a percent of actual price, 19 out of 31 items were overestimated (range, 103.7%–846.1%), 11 out of 31 were underestimated (range, 37.9%–96.5%), and one item was accurately estimated at 100% of actual price (individual estimates ranged from 18.5%–770.4%; **Figure 3**).

	Responses out of Total 56 n	Percent
In the current moment, do you feel that surgical device/equipment pricing is transparent?		
Definitely no	38	67.9
Somewhat no	13	23.2
Neither yes or no	4	7.1
Somewhat yes	1	1.8
Definitely yes	0	0.0
I feel that surgical device pricing should be transparent to physicians:		
Strongly agree	41	73.2
Agree	15	26.8
Neutral	0	0.0
Disagree	0	0.0
Strongly Disagree	0	0.0
How would you rate your knowledge of the surgical device/item prices at your institution?		
Poor	23	41.1
Below average	16	28.6
Average	13	23.2
Above average	3	5.4
Excellent	1	1.8
Does cost of instruments/devices affect which ones you choose during a surgery?		
Definitely yes	10	17.9
Probably yes	26	46.4
Might or might not	13	23.2
Probably not	6	10.7
Definitely not	1	1.8
How important should cost be in the selection of surgical devices/items?		
Extremely important	6	10.7
Very important	16	28.6
Moderately important	26	46.4
Slightly important	7	12.5
Not at all important	1	1.8

Table 3.
Price Estimate Accuracy as Percentages of Actual Price

	Mean % ± SD	Median	Range (Min-Max)
4-O Vicryl PS-2 (Ethicon, Somerville, NJ)	842.4 ± 1473.2	366.7	66.7–10,000.0
V-Care Plus (Conmed, Utica, NY)	707.4 ± 658.4	483.3	166.7–4166.7
EndoCatch Gold, 10 mm (Medtronic, Minneapolis, MN)	536.7 ± 549.7	350.0	62.5–3000.0
2–0 V-loc 90-day GS-22 (Medtronic, Minneapolis, MN)	489.9 ± 536.1	333.3	44.4–2772.2
Versapoint 5-mm trocar (Ethicon, Somerville, NJ)	468.8 ± 448.0	312.5	62.5–2083.3
Endopath XCEL 11-mm trocar (Ethicon, Somerville, NJ)	382.4 ± 463.4	206.9	51.7–2586.2
Stryker LSC insufflation tubing (Stryker, Kalamazoo, MI)	330.3 ± 353.2	232.6	58.1–2093.0
Surgicel Original (Ethicon, Somerville, NJ)	290.0 ± 334.3	159.4	14.5–1739.1
LigaMax 5-mm clip applier (Ethicon, Somerville, NJ)	263.9 ± 264.1	220.6	51.5–1471.0
0-Vicryl endoloop (Ethicon, Somerville, NJ)	246.9 ± 299.3	142.9	20.0–1428.6
Seprafilm Adhesion Barrier (Genzyme, Cambridge, MA)	207.9 ± 241.0	90.1	13.5–1081.1
0-Vicryl CT-1, 36" (Ethicon, Somerville, NJ)	199.3 ± 155.3	166.7	22.2–666.7
Tisseel Cannula only (Baxter, Deerfield, IL)	197.1 ± 219.5	131.6	17.5–877.2
Enseal 5-mm G-2 Articulating (Ethicon, Somerville, NJ)	172.6 ± 240.2	103.3	24.6–1476.4
Advincula Delineator (CooperSurgical, Trumbull, CT)	148.9 ± 99.7	142.9	35.7–500.0
Electrosurgical Pencil (Medtronic, Minneapolis, MN)	139.4 ± 100.5	125.0	16.7–500.0
LigaSure Maryland Jaw 5 mm (Medtronic, Minneapolis, MN)	130.7 ± 144.1	96.0	26.9–959.7
Harmonic Shears 5 mm (Ethicon, Somerville, NJ)	114.2 ± 78.2	87.0	25.2–434.8
LiNa Gold Loop (LiNA, Norcross, GA)	110.9 ± 121.1	70.4	11.1–555.6
LigaSure Impact (Medtronic, Minneapolis, MN)	106.8 ± 122.3	77.0	18.5–770.4
15-cm Anchor Bag (Conmed, Utica, NY)	103.7 ± 86.5	65.8	9.9–328.9
GenesisHTA disposables (Boston Scientific, Marlborough, MA)	93.0 ± 101.8	57.1	9.4–476.2
Symphion device disposables (Boston Scientific, Marlborough, MA)	85.4 ± 58.1	71.1	10.0–300.3
HALO PKS Cutting Forceps 5 mm (Olympus, Center Valley, PA)	78.3 ± 66.3	58.8	14.7–367.6
Interceed Adhesion Barrier (Ethicon, Somerville, NJ)	75.8 ± 87.6	52.1	3.5–416.7
Versapoint Angled Loop Electrode (Ethicon, Somerville, NJ)	74.8 ± 88.5	51.7	5.2–516.5
Novasure device disposables (Hologic, Marlborough, MA)	70.3 ± 56.6	50.3	13.1–251.3
GelPoint Mini (Applied Medical, Rancho Santa Margarita, CA)	67.0 ± 70.1	44.4	5.6–333.3
Mirena IUD (Bayer, Leverkusen, Germany)	62.4 ± 32.0	58.3	5.7–139.9
Solyx Single Incision mesh (Boston Scientific, Marlborough, MA)	40.5 ± 34.8	27.3	3.3–170.6
Upsilon Y-Mesh (Boston Scientific, Marlborough, MA)	40.2 ± 39.6	27.2	2.7–163.4

There were no statistically significant correlations of price accuracy with any of the demographic factors in our cohort. Specifically, we found no correlation of accuracy with physician reimbursement structure (salaried vs private practice vs salaried plus incentives), surgical volume, training status (attending vs residents and fellows), nor practice focus/subspecialty. In addition, there was no specific device group that was more accurately estimated than the others (bipolar devices, clips, trocars, accessories).

Self-rated knowledge of device pricing was also not associated with estimate accuracy (ANOVA probability values ranged from 0.10 to 0.49).

DISCUSSION

Our study found that obstetrician-gynecologist physicians had a 6.1% frequency of price-estimate accuracy for var-

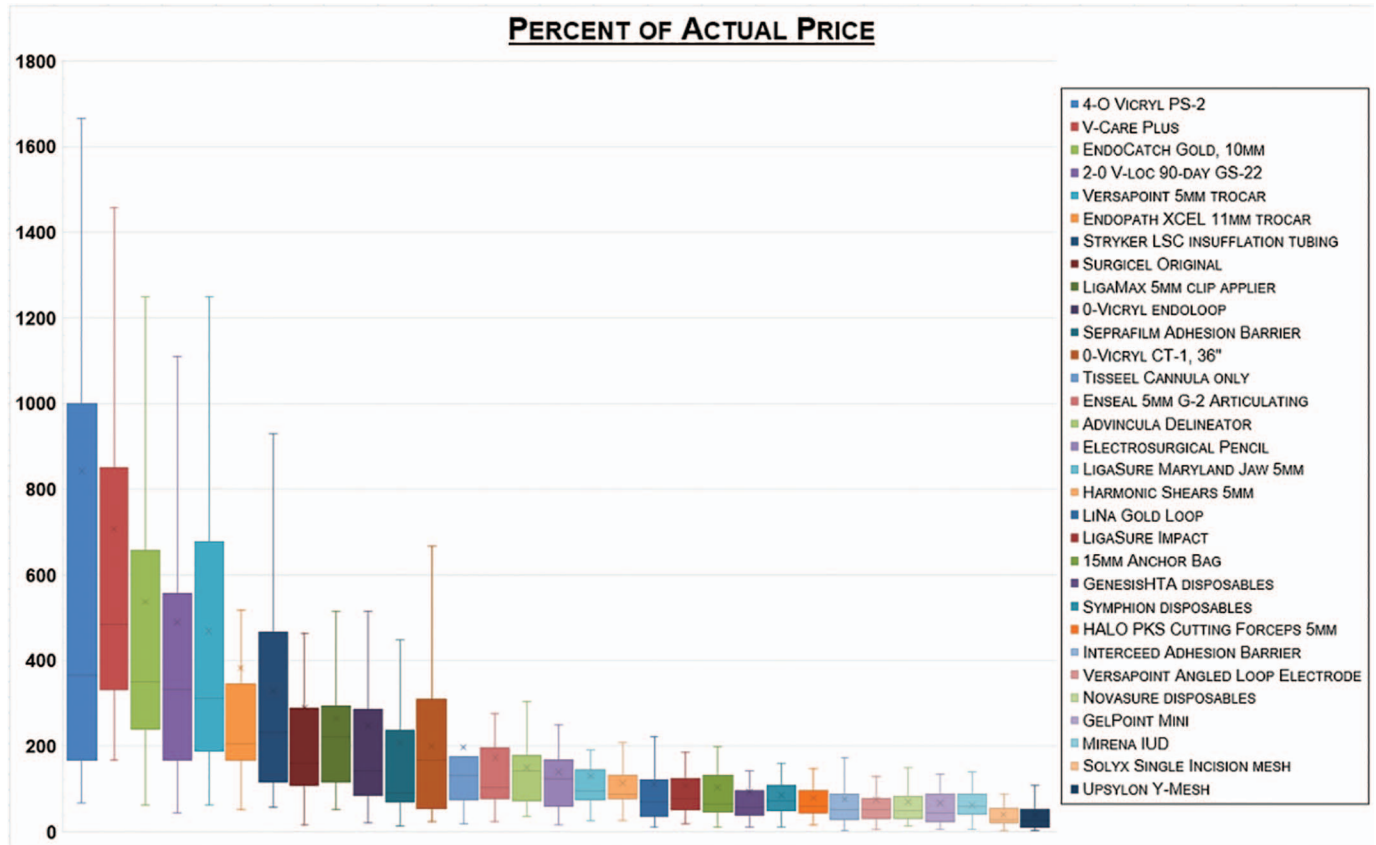


Figure 3. Price estimates as a percent of actual price by each item. Vertical axis is percent of actual price (0%–1800%) compared to actual price. Horizontal axis: surgical items. x: mean. Small horizontal line: median.

ious surgical devices and items. In addition, the entire study cohort reported a unanimous desire for price transparency, yet only 1.8% felt pricing was currently at least somewhat transparent.

With health care costs at nearly 18% of our gross domestic product and medical bills being the most common reason for filing personal bankruptcy, reduced spending is of paramount importance. Surgeons are uniquely equipped to help reduce costs significantly by making more cost-conscious choices at the time of surgery without compromising safety and efficiency. Despite the logic that educating surgeons on device prices may help to contain costs, studies have demonstrated that surgeons in numerous specialties generally have a poor understanding of device pricing and low levels of price education.^{3,5–8}

A similar study among otolaryngology surgeons demonstrated that price estimate accuracy was fairly low (12% for trainees, 25% for faculty) while self-rated

knowledge and years in practice were not associated with accuracy. Furthermore, a study of orthopedic surgeons found respondents accurately estimated prices on only 19% of items.^{5,6} Consistent with these studies in other surgical specialties, our data shows a similar trend of widespread inaccuracy of price estimates.

On average, our participants estimated prices with a $\pm 10\%$ accuracy on only 1.9 of the 31 items (6.1% of items); if our accuracy definition was expanded to $\pm 20\%$, there were only 6 physicians (12.5%) who could accurately estimate prices of 8 items or more out of 31 (25.8%). We hypothesized an improved accuracy by physicians in private practice, those with a higher surgical volume, increased number of years since residency, or being a surgical subspecialist; however, none of these factors were significant. We largely attribute these findings to no formalized publication of device prices at our institution and suspect a similar scenario exists nationwide at other institutions. We hypothesize

that a less significant contribution to this inaccuracy is a familiarity with prices and contracts outside of our hospital system.³

Most physicians self reported that price does affect which instruments they choose; however, most surgeons inaccurately estimated prices, which highlights a seemingly untapped potential for education. We also found a unanimous desire for price transparency, yet an almost universal perception of nontransparency. A prior study found that price education alone led to reduced surgery costs via education on controllable costs, formal presentation of surgeon cost data, and highlighting areas of potential cost savings, which significantly reduced laparoscopic hysterectomy cost by more than \$250 per case without a change in operating room time.⁹ Fifty-one percent of these cost savings were in decreased bipolar instrument cost. This highlights the notion that legislative price transparency policies and intra-institution physician education alone can lead to reduced surgical costs. Additionally, perhaps publication of prices may remove a roadblock to further improve price accuracy.

The Accreditation Council for Graduate Medical Education, American Board of Obstetrics and Gynecology, and the American College of Obstetrics and Gynecology have created a joint initiative titled, “The Obstetrics and Gynecology Milestone Project.”¹⁰ This tool for evaluating resident physicians contains a section on “Cost-effective Care and Patient Advocacy” wherein residents are evaluated on their ability to incorporate cost-awareness into clinical practice and practice cost-effective care. In our study, we found that residents at our institution were not more likely to estimate prices accurately than attending physicians. This highlights a call to action by the Accreditation Council for Graduate Medical Education (ACGME), American Board of Obstetrics and Gynecology, and American College of Obstetrics and Gynecology to promote price transparency to better equip residents with the information needed to meet this educational milestone.

Strengths of this study include our ability to precisely calculate accuracy because pricing is uniform at our single institution. In a retrospective power analysis in this pilot study, we calculated an 86% power to detect a 10% difference which was achieved. Another strength is that we included many generalists, thus representing what most obstetrician-gynecologists nationwide would estimate. Weaknesses include surveying at a single health care system in one state where transparency may not reflect

trends nationwide; however, we plan to expand the current study to reach a larger population which can potentially make the results more generalizable. In addition, the low purchasing prices at our large institution do not necessarily reflect those nationwide given our large purchasing volume, academic affiliation, and bargaining power; for example, the purchasing price of a single barbed suture at our institution is 15.2-fold lower than at an independent surgery center within the same zip code. Lastly, the low response rate can result in lower generalizability, however we suspect that similar results would be found given the dramatically low accuracy we observed.

The results of this study suggest a prime educational opportunity at our institution and we are developing a quality improvement project to reduce healthcare delivery costs. With our data as a baseline, education can be provided in person or via online modules. Subsequent surveys can be performed to evaluate how education changes price awareness. Operating room costs can be compared before and after this intervention. Alternatively, costs can be made available intra-operatively for each device utilized via a “price tag” or some other indicator. With patient safety as the utmost importance, these interventions may provide tools for providers to choose equally safe and effective inexpensive alternatives on a daily basis. Future studies are needed at multiple institutions accounting for respective hospital-specific pricing to evaluate if similar trends exist outside of our institution.

CONCLUSION

Our pilot survey study found that obstetrician-gynecologist physicians accurately estimated prices on only 6.1% of items without any association with the collected demographics. In addition, physicians unanimously desire transparency yet almost all feel it is absent. Our cohort generally expressed that price does affect which devices they utilize in surgery. We propose that transparency and price education can provide the desired information to obstetrician-gynecologist surgeons and may reduce surgical costs.

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