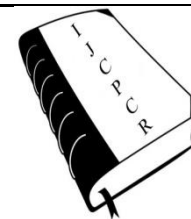




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UNDERSTANDING IMPLANTABLE MEDICAL DEVICE COSTS IN ORTHOPAEDIC SURGERY: A SURVEY OF HEALTHCARE PROVIDERS' KNOWLEDGE AND ESTIMATION ACCURACY

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ABSTRACT

This study examines healthcare providers' understanding of the costs associated with implantable medical devices (IMDs) in orthopaedic surgery. A questionnaire was administered to orthopaedic surgeons and residents to assess their comfort level and understanding of IMD costs. Responses were used to estimate the costs of 26 commonly used orthopaedic devices, with a response rate of 54% achieved from 102 surgeons. The study found that over 2.2% of respondents rated their knowledge of IMD costs as poor. On average, respondents' estimations had a mean percentage error of 70%, with 68% underestimations and 34% overestimations. Residents exhibited a higher average percentage error (74%) compared to attending surgeons (60%). Furthermore, accuracy varied depending on the specific IMD being estimated. Overall, both residents and attending surgeons demonstrated inadequate knowledge of orthopaedic IMD costs, highlighting the need for improved healthcare cost control strategies and further exploration of physicians' conceptualization of material costs.

Key words: Orthopaedic Surgery, Implantable Medical Devices (Imds), Healthcare Cost Control, Surgeon Knowledge, Cost Estimation.

INTRODUCTION

It has been widely reported both by the press and by the orthopaedic literature that American health-care spending is increasing at an unsustainable rate. IMD costs totaled USD 80 billion in 2007, and orthopaedic implant costs alone were forecast to grow by 9.8% annually to USD 23 billion by 2012 [1]. Government Accountability Office (GAO) reports that over a 5-year period from 2004 to 2009, IMD expenditures increased from 16.1 billion to 19.8 billion, and orthopaedic devices contributed most to this increase [2]. Medicare already spends the most on TKAs and THAs [3]. In a study of 61 hospitals in 2008, Robinson et al. found that total hip and knee implants accounted for 13% to 87% of the total cost of these procedures.

In the orthopaedic IMD industry, pricing contracts are usually confidential between hospitals and manufacturers. Healthcare cost control may be impacted by lack of knowledge about implant pricing among orthopaedic surgeons. According to a recent editorial [4],

both patients and surgeons often believe that "newer is better" when neither pays for orthopaedic implants directly. Costs have risen by more than 100% for hips and knees over the past decade [5], making it difficult to control. Orthopaedic IMD cost education is not traditionally part of training programs' responsibilities. Due to the introduction of new devices and the rapid change of healthcare landscapes rapidly change, orthopaedic surgeons will require more information about the costs and benefits associated with these devices. The surgeon is only able to participate in cost containment if he or she knows the cost of the materials. It is unclear how much residents and attending surgeons know about IMD costs.

In our study, we assessed the comfort level among residents and attending surgeons with orthopaedic IMD costs, assessed surgeons' understanding of orthopaedic IMD costs, determined which constructs led to the most accurate cost estimates.

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METHODS AND MATERIALS

In two high-volume medical centers, 120 orthopaedic residents filled out an anonymous 34-item questionnaire. The questionnaire was emailed, while in the second, it was administered during grand rounds. There was no prior knowledge that the questionnaire would be given to residents or attending surgeons. 102 surgeons completed the questionnaire, 72 were residents and 30 were attendings. There was a 54% response rate overall. We received 58 responses from one institution and 44 from the other. Respondents ranged in experience from less than five years to more than 25 years, including residents of all levels of training. Prior to completing the questionnaire, respondents listed their training years or experience, and rated their perception of implant costs. The next step was to ask respondents to estimate hospital costs for 26 orthopaedic IMDs. [6] In internal fixation constructs, the number of screws used or the amount of bone cement used, were detailed descriptions of these IMDs. Following the collection of questionnaires, respondents were divided into resident and attending surgeon groups. A further division was made according to training years or practice years for attending surgeons. Because both institutions needed to maintain confidentiality, we compared the responses to the questionnaire with the actual costs of the hospital. Upon verification with IMD personnel, there was not a cost difference of greater than 6%. Orthopaedic IMD retail costs are easier to obtain, but they don't reflect true hospital costs. Using the difference between the respondents' estimated and actual hospital costs, the percentage error

was calculated. For the final analysis, only percentage errors were used to protect manufacturer contracts. The percentage error is calculated by subtracting the hospital cost of the implant from the respondent's estimated cost. Both residents and attending surgeons made mean percentage errors. The mean percentage error was calculated from each percentage error's absolute value.

RESULTS

According to the survey, 2 respondents knew orthopaedic implant prices well, 24 knew fair, 64 knew poor, and five knew none. The study population's cost estimation error was 70% ± 43%. Residents and attending surgeons underestimated nearly equally. There was a mean underestimation of 53%, and a mean overestimation of 105%. There was a greater mean percentage error observed for residents than for attending surgeons (Table 1). At their best, residents estimated locking plates for the distal radius and clavicle with the greatest accuracy; however, the mean errors for these constructs were 51% and 58%, respectively, meaning that the residents were accurate by approximately 2.2 percent of the implant's cost. The residents were least accurate in estimating the cost of a dynamic compression plate for the distal radius and an anterior cervical fusion. [7] Surgical attendings were most accurate when estimating the cost of a cemented total knee and a sliding hip screw, whereas they were least accurate when estimating the cost of a dynamic compression plate and an anterior cervical fusion (Table 2).

Table 1: All participants' error percentages

Participant	Number of respondents	Mean percentage errors	SD
All Surgeons	118	138	84
Surgeons who are attending	30	118	18
Residents	72	146	100
PGY-1	18	120	154
PGY-2	18	130	90
PGY-3	10	104	66
PGY-4	16	104	58
PGY-5	10	110	46

Table 2: Each device's percentage error for all respondents

Devices	Mean percentage error	
	Attending surgeons (30 respondents)	Residents (72 respondents)
Locking plate for distal radius	86	100
Dynamic radius	244	222
Compression plate		
Locking plate for the clavicle	152	114
Screws for sliding hips	78	116
Cephalomedullary nail	98	132
TKA with cemented tibia	72	116
TKA with all polyethylene tibia	88	122
Fusion of the anterior cervical spine construct	192	206

Construct for posterior cervical fusion	106	124
Morphogenetic bone	160	122
Proteins		
Matrix of demineralized bone	102	178
Cement for bones	114	120
Infected with antibiotics	150	156

DISCUSSION

Orthopaedic surgeons' knowledge of surgical materials costs is critical to the success of cost control measures. As prices vary within the industry, surgeons may find it difficult to determine materials costs. In order to (1) determine orthopedic residents' and attending surgeons' comfort with orthopedic IMD costs, (2) quantify how accurately surgeons understand orthopedic IMD costs, and (3) find out the most accurate method of estimating orthopedic IMD costs. [8]

There were limitations to this study. We were unable to examine differences between community practice settings because all surgeons trained in large, high-volume academic institutions with large numbers of patients. Identifying why academics and community practitioners understand prices differently would be possible through further investigation. Any discussion of such a difference should start with our study. One of our institutions provided us with the figures for our true hospital costs. Our institutions cannot share cost data due to confidentiality agreements. [9] According to our survey respondents, costs did not differ more than 6%. In our investigation, we did not use retail costs because they are inaccurate representations of our institutions' true costs. IMDs are discounted significantly by hospitals, making hospital costs less than retail prices. Using retail costs may have led to even greater errors since most responses underestimated the costs. Physicians' lack of interest in IMDs may explain our low response rate. The low response rate is more of a problem than a limitation, since it may indicate surgeons' ignorance of IMD prices due to their interest in implant pricing.

IMD costs for orthopaedics are not well understood by most respondents. In some cases, hospitals pay manufacturers more than surgeons for IMDs used during surgical procedures [10]. As these costs are billed directly to patients, the GAO is investigating them and will incorporate them into Medicare's prospective payment system in 2013. Hospital prices for the same device varied by 78% to 83% according to the GAO investigation, and relationships between physicians and manufacturers played a significant role in this difference [11]. This same conclusion was reached who found that THA implants ranged from USD 2392 to USD 12,651, and TKA implants ranged from USD 1797 to USD 12,093. As a result of contracts between hospitals and manufacturers, surgeons in

our study did not have an accurate understanding of IMD costs. [12] The GAO report discusses the difficulty in obtaining this data.

Our study demonstrated poor accuracy in cost estimation. Overall, five residents had greater than 100% incorrect IMD cost knowledge, compared to 44 residents and 20 attending surgeons. Orthopaedic IMDs were discounted considerably, but most responses were underestimated. The best way to educate surgeons about these costs is unclear. Neither of our institutions currently lists operating room materials' prices directly on the packaging, possibly due to confidentiality agreements. Colored stickers show high, medium, and low costs on IMDs due to confidentiality agreements. Following the Justice Department's probe and prosecution of orthopaedic device manufacturers, surgeons and manufacturers will be highly scrutinized for direct collaboration in education, especially during residency. Negotiating device prices with hospitals is complicated by surgeon-industry relationships [13].

Cost estimation accuracy varied by implant. A material's or device's familiarity influences cost knowledge. Across groups, anterior cervical fusion constructs showed poor accuracy, a highly specialized device used by a relatively small number of surgeons. Cemented TKAs and sliding hip screws are commonly used by attending surgeons. The comparison of costs between some of these implants may also explain this pattern. We found that newer products have a higher percentage of errors, and because these products are also more expensive, the errors are magnified. Surgeons can learn more about pricing information from other surgeons or orthopaedic literature if presented with it.

CONCLUSION

Most orthopaedic surgeons can only obtain cost information from these discussions and other surgeons' academic work because of confidentiality agreements and industry nontransparency. The learning model needs major changes based on our results. The cost of orthopaedic IMD is poorly known by orthopaedic surgeons. It is imperative for surgeons to have a thorough understanding of IMD pricing in a scrutinized healthcare environment. The current level of expenditures cannot be sustained, so surgeons should be educated on the advantages and disadvantages of using them.

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