

Transparency to Reduce Surgical Implant Waste

Kiel J. Pfefferle, MD*, Matthew F. Dilisio, MD*, Brianna Patti, MD*,
Stephen D. Fening, PhD*[†], Jeffrey T. Junko, MD*

*Department of Orthopaedic Surgery, Summa Health System, Akron, OH,

[†]Austen BioInnovation Institute, Akron, OH, USA

Background: Rising health care costs and emphasis on value have placed the onus of reducing healthcare costs on the surgeon.

Methods: Financial data from 3,973 hip, knee, and shoulder arthroplasties performed at a physician owned orthopedic hospital was retrospectively reviewed over a two-year period. A wasted implant financial report was posted starting the second year of the study. Each surgeon's performance could be identified by his peers.

Results: After posting of the financial report, 1.11% of all hip and knee arthroplasty cases had a waste event compared to 1.50% during the control year. Shoulder arthroplasty waste events occurred twice as often than that observed in hip and knee arthroplasty during the study period. A decrease in waste events was observed but was not statistically significant ($p = 0.30$).

Conclusions: Posting a non-blinded wasted implant data sheet was associated with a reduction in the number of wasted orthopedic surgical implants in this series, although the reduction was not statistically significant.

Keywords: *Implant waste, Knee arthroplasty, Hip arthroplasty*

In orthopaedic surgery today, the combination of rising healthcare costs, imminent policy reform, emphasis on patient value, and decreased reimbursement has placed the onus of reducing costs on the surgeon. In particular, the combination of rising implant costs and decreased reimbursement for orthopaedic procedures has contributed to a marked decrease in profitability across all subspecialties.¹⁻³⁾ With the predicted rise in demand for elective procedures⁴⁻⁷⁾ and the ever-present demand for orthopaedic trauma services,⁸⁾ it is beneficial for both individual surgeons and hospital systems to identify methods to maintain profitability in a world of ever-shrinking margins.

Significant strides have been made in the last twenty years in reducing operative cost in orthopaedic surgery such as efficient use of an operative room, well-organized surgical technique, and the use of specialized intraopera-

tive support staff. Cost containment and cost reduction programs are aimed to ensure both healthcare value and maintained profitability. While there have been numerous cost containment strategies attempted within both various orthopaedic subspecialties as well as specific hospital systems in the last decade,⁹⁻¹⁴⁾ only a select few have specifically focused on intraoperative implant waste.¹⁵⁻¹⁷⁾ Previous work has demonstrated that orthopaedic implant waste represents a significant source of health care cost.

The purpose of this study was to report on a simple reporting method that attempts to socially and psychologically compel a large group of orthopaedic surgeons to reduce surgical implant waste. We hypothesize that a significant waste reduction will be seen with implementation of a publically posted implant report.

METHODS

Financial billing and coding data from 3,973 hip (CPT 27130), knee (CPT 27447), and shoulder (CPT 23472) arthroplasties conducted at a physician owned orthopedic specialty hospital (Crystal Clinic Orthopaedic Center, Akron, OH, USA) was retrospectively reviewed over a two

Received February 19, 2014; Accepted December 30, 2014

Correspondence to: Kiel J. Pfefferle, MD

Department of Orthopaedic Surgery, Summa Health Systems, 444 N Main St, Akron, OH 44310, USA

Tel: +1-330-379-5681, Fax: +1-330-379-5053

E-mail: Kiel.pfefferle@gmail.com

Copyright © 2015 by The Korean Orthopaedic Association

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Clinics in Orthopedic Surgery • pISSN 2005-291X eISSN 2005-4408

year period (2010 to 2011). Implant waste was defined as "... during the course of a surgical procedure, it was unpackaged or otherwise prepared for use but ultimately did not remain implanted in the patient at the end of surgery and could not be reused in a different patient."¹⁵ All waste data was collected by the nursing staff during the operative procedure and recorded. A wasted implant financial report was posted in the surgery lounge starting the second year of the study. Surgeon identity was not blinded, and each surgeon's performance could be identified by his peers. This intervention year was compared to the prior year when the financial wasted implant data was not made available to the surgeon. The data was analyzed based on hip and knee arthroplasty implant waste as well as shoulder arthroplasty alone. Descriptive statistics were performed for all groups. Potential differences between rates and proportions of occurrences were assessed with the use of a Pearson chi-square test. Significance was set at a two-tailed $\alpha < 0.05$. This project qualified for Institutional Review Board exemption.

RESULTS

Hip and Knee Arthroplasty

In 2010, 25 of 1,662 total hip arthroplasty (THA) and total knee arthroplasty (TKA) cases had a waste event (1.50%) for an average cost of \$2,555.13 per event (Table 1). In 2011, 21 of 1,888 THA and TKA cases had a waste event (1.11%) for an average cost of \$4,878.32 per event. The difference in proportions between 2010 and 2011 was $0.39\% \pm 0.75\%$ (95% confidence interval [CI]). Although there was a decrease in arthroplasty waste events between 2010 and 2011, the reduction was not statistically significant ($p = 0.30$). The cost associated with waste accounted for 0.32% and 0.55% of the total cost associated with hip and knee arthroplasty implants in 2010 and 2011, respectively.

Shoulder Arthroplasty

In 2010, 7 of 206 shoulder arthroplasty cases had a waste event (2.47%) for an average cost of \$1,149.92 per event (Table 2). In 2011, 7 of 224 shoulder arthroplasty cases had a waste event (2.27%) for an average cost of \$626.46 per

Table 1. Waste Event Data for Hip and Knee Arthroplasty

Hip and knee arthroplasty	2010	2011
Waste	25	21
No-waste	1,637	1,867
Total	1,662	1,888
Waste probability (%)	1.50	1.11
Proportion difference (%)	0.39 ± 0.75 (95% confidence interval), $p = 0.30$	
Cost per waste event (\$)	$2,555.13 \pm 572.97$	$4,878.32 \pm 1,138.10$
Proportion spent on waste (%)	0.32	0.55

Table 2. Waste Event Data for Shoulder Arthroplasty

Shoulder arthroplasty	2010	2011
Waste	7	7
No-waste	199	217
Total	206	224
Waste probability (%)	2.47	2.27
Proportion difference (%)	0.27 ± 3.36 (95% confidence interval), $p = 0.87$	
Cost per waste event (\$)	$1,149.92 \pm 433.04$	626.46 ± 436.69
Proportion spent on waste (%)	1.10	0.55

event. The difference in proportions between 2010 and 2011 was $0.27\% \pm 3.36\%$ (95% CI). Although there was a decrease in arthroplasty waste events between 2010 and 2011, the reduction was not significantly significant ($p = 0.87$). The cost associated with waste accounted for 1.10% and 0.56% of the total cost associated with shoulder arthroplasty implants in 2010 and 2011, respectively.

DISCUSSION

Several authors have previously reported the cost burden of implant waste within the disciplines of total joint arthroplasty,¹⁵⁾ orthopaedic spine surgery,¹⁶⁾ and orthopaedic trauma surgery.¹⁷⁾ In these studies, an implant was considered waste when "...during the course of a surgical procedure, it was unpackaged or otherwise prepared for use but ultimately did not remain implanted in the patient at the end of surgery and could not be reused in a different patient."¹⁵⁾ The first study, which examined waste in the subspecialty of total joint arthroplasty, demonstrated an average incidence of 2% and annualized average cost of over \$100,000 per hospital.¹⁵⁾ This extrapolates to \$36 million dollars per year for the entire United States and a predicted \$112 million per year with the anticipated increase in demand for total joint arthroplasty by 2030. Interestingly, there was no difference in incidence when comparing academic hospitals to community institutions. In contrast, a similar study examining orthopaedic trauma surgery found more waste in community hospital settings versus academic institutions. These authors additionally noted that the low incidence (0.6%) and annualized cost (\$18,000 per hospital) of trauma implant waste was unlikely to decrease significantly with even the most stringent of interventions.¹⁷⁾ A third article investigating spine surgery implant waste noted an annualized cost of \$126 million per year for the entire United States, similar to the first study, with waste occurring in approximately 20% of all cases.¹⁶⁾ This study went further, however, and implemented an educational program on intraoperative waste for all operative room staff and posted a public, monthly tally of individual surgeon's implant waste and associated cost burden, without anonymity (spine). These achieved a remarkable 50% reduction in incidence (20.2% to 10.3%) and a cost reduction of 66% (\$212,000 annually per hospital to \$70,000).

The results from this study did show a trend toward decreasing waste events in the hip and knee arthroplasty as well as the shoulder arthroplasty group. After the wasted implant financial report was posted, 1.11% of all hip and knee arthroplasty cases had a waste event com-

pared to 1.50% during the control year. Although there was a decrease in waste events after posting the report, the reduction was not significantly significant ($p = 0.30$). This resulted in an absolute waste reduction was $0.39\% \pm 0.75\%$ (95% CI). The cost associated with waste accounted for 0.55% and 0.32% of the total cost associated with hip and knee arthroplasty implants in the intervention and control year, respectively.

When comparing to previously published arthroplasty implant waste literature,¹⁵⁾ the results of this study showed a lower proportion of cost associated with implant waste for hip and knee arthroplasty (0.32% to 0.55% vs. 2%). The data from this study was recorded from a for-profit physician owned hospital; thus, the surgeons may have already been aware of significant profit loss from implant waste. Therefore, their surgical implant waste may have already been minimized prior to this study.

Shoulder arthroplasty waste accounted for 182% greater proportional cost than observed in hip and knee arthroplasty during the study period. In an effort to reduce implant waste, efforts should be focused specifically on shoulder arthroplasty cases. More attention should be paid to component trialing prior to implantation of the final prosthesis in order to achieve more accurate sizing. In addition, the final humeral bearing (head or liner) should not be opened on the sterile field until the shoulder is re-trialed with the definitive stem to ensure subsidence did not alter the final optimal humeral component size.

It appears that with current techniques there will be a small percentage of cost associated with surgical implant waste during joint reconstruction surgery. It is the up to the surgeon and hospital system to continue to investigate methods to minimize surgical waste and the associated cost.

The current healthcare climate in the United States is forcing both surgeons and healthcare systems to find novel ways to decrease healthcare costs while maintaining quality outcomes. Posting a non-blinded wasted implant data sheet was associated with a reduction in the number of wasted orthopedic surgical implants in this series, although the reduction was not statistically significant. A higher powered study may have demonstrated significance. Since shoulder arthroplasty represented 182% greater proportional cost than observed in hip and knee arthroplasty during the study period, shoulder arthroplasty represents an appropriate target to reduce healthcare costs with further implant waste reduction strategies.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

ACKNOWLEDGEMENTS

The authors are appreciative to Annie Piccorelli at the University of Akron for statistical consultation.

REFERENCES

1. Hariri S, Bozic KJ, Lavernia C, Prestipino A, Rubash HE. Medicare physician reimbursement: past, present, and future. *J Bone Joint Surg Am.* 2007;89(11):2536-46.
2. Eastman AB, Bishop GS, Walsh JC, Richardson JD, Rice CL. The economic status of trauma centers on the eve of health care reform. *J Trauma.* 1994;36(6):835-44.
3. Thal ER, Rochon RB. Inner-city trauma centers: financial burdens or community saviors? *Surg Clin North Am.* 1991;71(2):209-19.
4. Kurtz S, Ong K, Lau E, Mowat F, Halpern M. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. *J Bone Joint Surg Am.* 2007;89(4):780-5.
5. Kim S. Changes in surgical loads and economic burden of hip and knee replacements in the US: 1997-2004. *Arthritis Rheum.* 2008;59(4):481-8.
6. Deyo RA, Gray DT, Kreuter W, Mirza S, Martin BI. United States trends in lumbar fusion surgery for degenerative conditions. *Spine (Phila Pa 1976).* 2005;30(12):1441-5.
7. Jacobs JJ. The burden of musculoskeletal disease in the United States: prevalence, societal and economic cost. Rosemont, IL: American Academy of Orthopaedic Surgeons; 2011.
8. MacKenzie EJ, Hoyt DB, Sacra JC, et al. National inventory of hospital trauma centers. *JAMA.* 2003;289(12):1515-22.
9. Healy WL, Finn D. The hospital cost and the cost of the implant for total knee arthroplasty: a comparison between 1983 and 1991 for one hospital. *J Bone Joint Surg Am.* 1994;76(6):801-6.
10. Zuckerman JD, Kummer FJ, Frankel VH. The effectiveness of a hospital-based strategy to reduce the cost of total joint implants. *J Bone Joint Surg Am.* 1994;76(6):807-11.
11. Patterson P, Mathias JM. Getting a grip on costs and usage of spinal implant technologies. *OR Manager.* 2006;22(2):1, 8, 11.
12. Bridges M, Diamond DL. The financial impact of teaching surgical residents in the operating room. *Am J Surg.* 1999;177(1):28-32.
13. Healy WL, Kirven FM, Iorio R, Patch DA, Pfeifer BA. Implant standardization for total hip arthroplasty: an implant selection and a cost reduction program. *J Arthroplasty.* 1995;10(2):177-83.
14. Johnston DW, Beaupre LA, Davies DM, Hessels R. Reducing arthroplasty costs via vendor contracts. *Can J Surg.* 1999;42(6):445-9.
15. Zywiell MG, Ulrich SD, Suda AJ, Duncan JL, McGrath MS, Mont MA. Incidence and cost of intraoperative waste of hip and knee arthroplasty implants. *J Arthroplasty.* 2010;25(4):558-62.
16. Soroceanu A, Canacari E, Brown E, Robinson A, McGuire KJ. Intraoperative waste in spine surgery: incidence, cost, and effectiveness of an educational program. *Spine (Phila Pa 1976).* 2011;36(19):E1270-3.
17. Zywiell MG, Delanois RE, McGrath MS, Ulrich SD, Duncan JL, Mont MA. Intraoperative waste of trauma implants: a cost burden to hospitals worth addressing? *J Orthop Trauma.* 2009;23(10):710-5.