

Postoperative Pain Management in Association With Total Cost of Care Among Patients Undergoing Total Knee Arthroplasty in the Hospital Outpatient Department: A Real-World Retrospective Cohort Assessment

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OBJECTIVE

To evaluate the association between liposomal bupivacaine (LB) use and total cost of care (defined as costs from the index surgical visit through 30 days after surgery) among patients undergoing total knee arthroplasty (TKA) in hospital outpatient departments (HOPDs), and to assess whether economic outcomes differed between LB and non-LB cohorts among patients treated in prespecified hospitals, including teaching hospitals

CONCLUSIONS

- In outpatient TKA performed in HOPDs, LB use was associated with numerically lower healthcare costs across the total 30-day episode of care in the matched population
- Among teaching hospitals, where implementation may be optimized, LB use was associated with economically meaningful and statistically significant reductions in total 30-day episode of care exceeding \$1500 compared with non-LB use
- These findings underscore the importance of LB as a cost-effective strategy for postoperative pain management, with potential for broad adoption through structured iteration and care standardization



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ACKNOWLEDGEMENTS: This study was funded by Pacira BioSciences, Inc. Assistance with poster preparation was provided under the authors' direction by Elissa R. Ettinger, MD, and Eleanore Cross, PhD of Fingerprint Medical and funded by Pacira BioSciences, Inc.

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INTRODUCTION

- TKA is a surgical procedure commonly used for alleviating joint pain in patients with severe knee osteoarthritis (OA)¹⁻³
- Despite being the gold standard surgical treatment for knee OA, patients undergoing TKA may experience moderate-to-severe postoperative pain, which can delay rehabilitation and increase opioid use¹
- Advances in surgical technique, anesthesia, and multimodal analgesic strategies have enabled appropriately selected TKA procedures to transition from inpatient settings to HOPDs⁴⁻⁶
- While TKA procedures continue migrating to HOPDs, evaluating healthcare costs not only for the index procedure alone, but also for the 30 days after surgery has become increasingly relevant
- The Premier Healthcare Database provides large-scale, real-world hospital administrative data appropriate for evaluating utilization patterns and cost performance across diverse US institutions
- LB is a long-acting local anesthetic formulation designed to prolong regional anesthesia¹
- To address the economic implications of LB use in TKA, this study compared total cost of care among patients treated with and without LB in the HOPD setting

RESULTS

- Of 17,559 eligible patients who underwent TKA at HOPDs, 7840 were successfully matched (3920 per cohort), yielding balanced comparison cohorts (Table)

Table. Baseline Demographic and Clinical Characteristics (Unmatched and Matched Cohort)

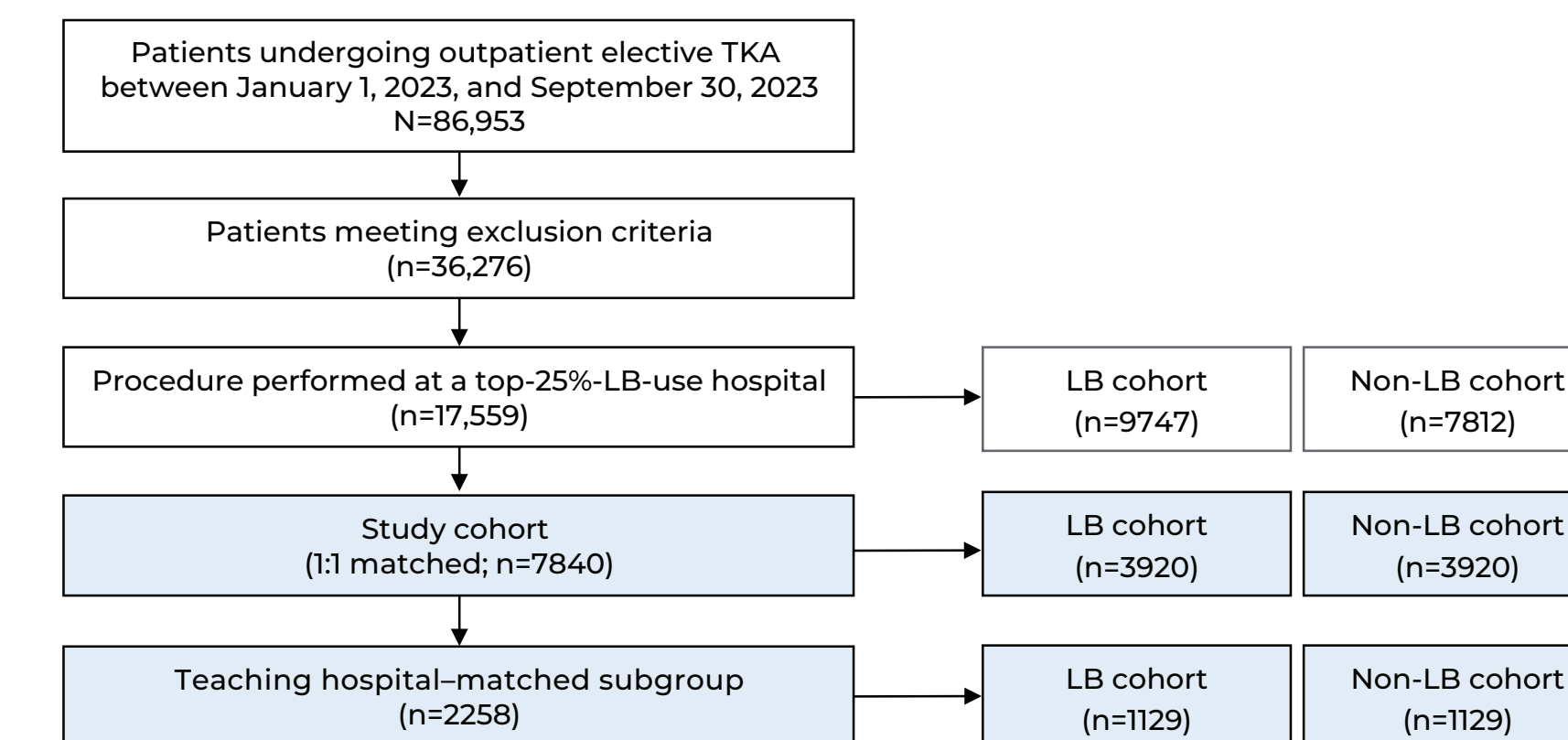
	Unmatched cohort			Matched cohort		
	LB (n=9747)	Non-LB (n=7812)	P-value	LB (n=3920)	Non-LB (n=3920)	P-value
Patient characteristics						
Age, mean (SD), y	68.35 (8.83)	68.12 (8.95)	0.0869	70.94 (8.54)	68.70 (8.36)	<0.0001
Sex, male, n (%)	3837 (39.4)	3089 (39.5)	0.4373	1544 (39.4)	1566 (39.9)	0.5356
Race, n (%)			<0.0001			0.1756
White	8105 (83.2)	6374 (81.6)		3242 (82.7)	3169 (80.8)	
Black	817 (8.4)	900 (11.5)		355 (9.1)	391 (10.0)	
Asian	129 (1.3)	112 (1.4)		50 (1.3)	62 (1.6)	
Unknown	696 (7.1)	426 (5.5)		273 (7.0)	298 (7.6)	
Ethnicity, n (%)			<0.0001			0.0357
Hispanic	413 (4.2)	305 (3.9)		138 (3.5)	182 (4.6)	
Non-Hispanic	8255 (84.7)	6948 (88.9)		3396 (86.6)	3372 (86.0)	
Unknown	1079 (11.1)	559 (7.2)		386 (9.8)	366 (9.3)	
Health insurance status, n (%)			0.0008			NA
Medicare	6514 (66.8)	5088 (65.1)		2714 (69.2)	2714 (69.2)	
Medicaid	215 (2.2)	236 (3.0)		82 (2.1)	82 (2.1)	
Commercial insurance	2639 (27.1)	2172 (27.8)		1014 (25.9)	1014 (25.9)	
Uninsured	18 (0.2)	28 (0.4)		1 (0.0)	1 (0.0)	
Other/Unknown	361 (3.7)	288 (3.7)		109 (2.8)	109 (2.8)	
CCI score, mean (SD)	0.77 (1.174)	0.82 (1.209)	0.0014	-	-	
Hospital characteristics						
Hospital size, n (%)			<0.0001			NA
1-299 beds	4661 (47.8)	4296 (55.0)		2130 (54.3)	2130 (54.3)	
300-499 beds	2770 (28.4)	1817 (23.3)		1034 (26.4)	1034 (26.4)	
≥500 beds	2316 (23.8)	1699 (21.7)		756 (19.3)	756 (19.3)	
Teaching hospital, n (%)	2965 (30.4)	2766 (35.4)	<0.0001	1130 (28.8)	1130 (28.8)	NA
Urban hospitals, n (%)	8841 (90.7)	7300 (93.4)	<0.0001	3609 (92.1)	3609 (92.1)	NA
Geographic location, n (%)			<0.0001			NA
Midwest	1343 (13.8)	2422 (31.0)		543 (13.9)	543 (13.9)	
Northeast	1117 (11.5)	252 (3.2)		235 (6.0)	235 (6.0)	
South	6886 (70.6)	4806 (61.5)		2947 (75.2)	2947 (75.2)	
West	401 (4.1)	332 (4.2)		195 (5.0)	195 (5.0)	

CCI, Charlson Comorbidity Index; LB, liposomal bupivacaine; NA, not applicable; SD, standard deviation.

METHODS

- This retrospective cohort study used the Premier Healthcare Database, a large, real-world, US all-payer hospital-based electronic healthcare database capturing patient-level utilization and cost data
- Adults undergoing elective TKA in HOPDs between January 1, 2023, and September 30, 2023, were identified (Figure 1)
- Facilities were restricted to those in the top quartile of LB utilization to reflect established implementation patterns²
- The LB and non-LB cohorts were 1:1 exactly matched on payer type, hospital facility, Charlson Comorbidity Index, and age (±2 years); additional adjustments were made for diabetes and chronic pulmonary disease in this matched cohort
- Adjusted mean total episode-of-care costs at the index surgical visit and through 7 and 30 days were estimated using generalized linear regression models (with gamma distribution and log link), with differences between cohorts and 95% confidence intervals (95% CIs) derived via bootstrapping (1000 resamples)

Figure 1. Patient selection and matched cohort derivation.



LB, liposomal bupivacaine; TKA, total knee arthroplasty.

- In the overall matched study cohort, LB use was associated with numerically lower adjusted mean costs than non-LB use at each evaluated time point (index surgical visit, 7 days since surgery, and 30 days since surgery; Figure 2)
 - Index surgical visit: \$15,600 versus \$15,719 (Δ-\$119; 95% CI, -\$477 to \$221)
 - Through 7 days: \$15,692 versus \$15,805 (Δ-\$113; 95% CI, -\$460 to \$218)
 - Through 30 days: \$15,949 versus \$16,056 (Δ-\$108; 95% CI, -\$489 to \$262)

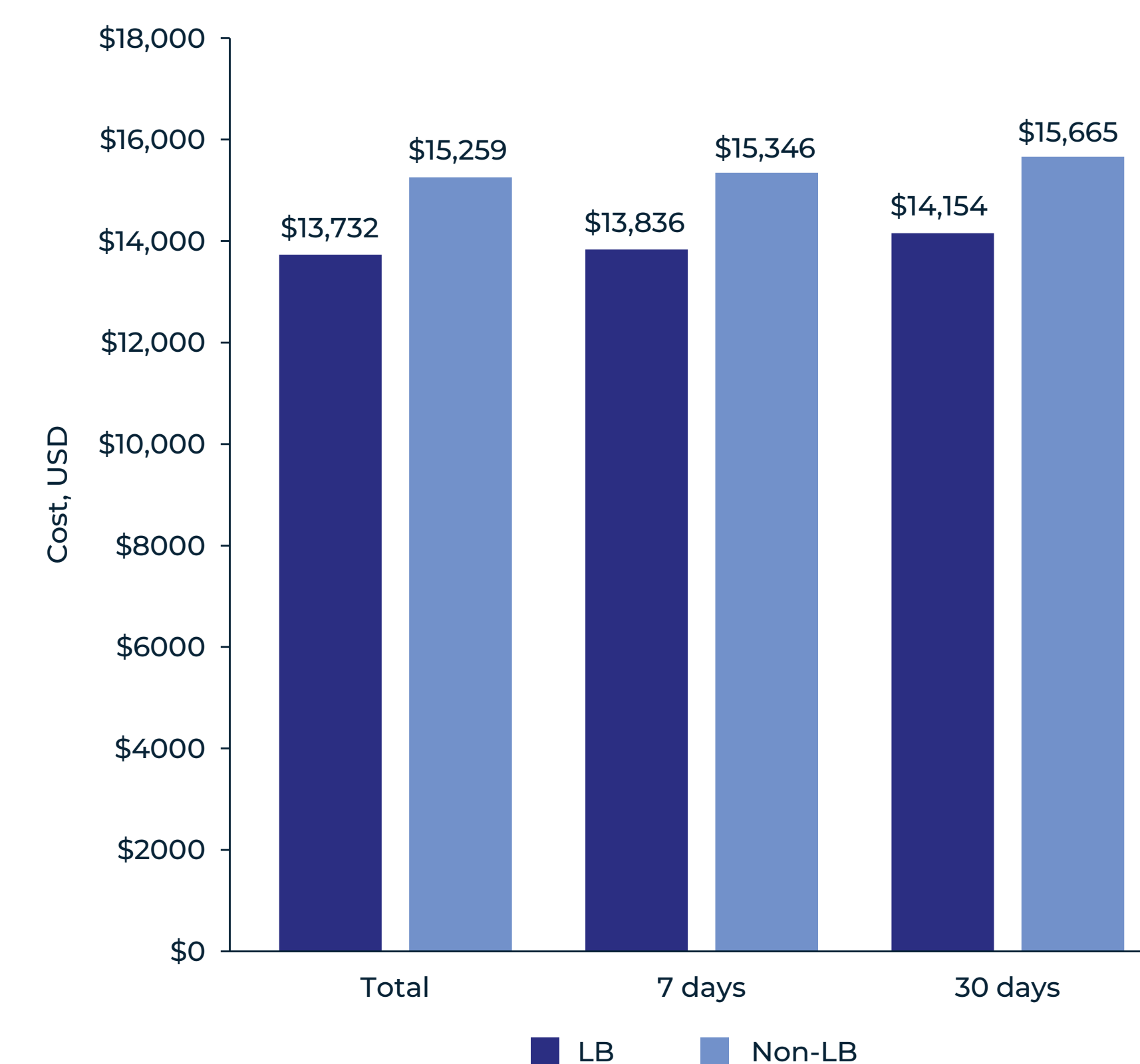
Figure 2. Adjusted total cost of care for TKA in the overall matched study cohort.



LB, liposomal bupivacaine; TKA, total knee arthroplasty; USD, United States dollars.

- In teaching hospitals, LB use was associated with consistent and statistically significant reductions in adjusted costs at each evaluated time point (index surgical visit, 7 days since surgery, and 30 days since surgery; Figure 3)
 - Index surgical visit: Δ-\$1527 (95% CI, -\$2292 to -\$725)
 - Through 7 days: Δ-\$1511 (95% CI, -\$2314 to -\$656)
 - Through 30 days: Δ-\$1511 (95% CI, -\$2323 to -\$753)
- The lower costs on the day of surgery (ie, the index surgical visit) observed in teaching hospitals were driven primarily by the pharmacy department where costs were at least \$1841 lower in the LB cohort compared with the non-LB cohort

Figure 3. Adjusted total cost of care in the teaching hospitals.



LB, liposomal bupivacaine; USD, United States dollars.