**We would be happy to present this work as either a podium or poster

Background: Robotic-assisted total knee arthroplasty (RA-TKA) has emerged as a technology to improve surgical precision and patient outcomes. This study evaluated national utilization trends, perioperative complications, readmissions, and costs associated with RA-TKA compared to conventional manual TKA.

Methods: This retrospective cohort study analyzed 466,748 primary TKA procedures from the Premier Healthcare Database (2016–2022), including 4,527 RA-TKA and 462,221 manual TKA cases. Multivariate regression models assessed complications, 90-day readmissions, and episode-of-care costs while adjusting for patient demographics, comorbidities, and insurance status.

Results: RA-TKA utilization grew steadily but remained at 1.0% of total TKA volume by 2022. Robotic patients were younger (64.6 vs 67.3 years, $p < 0.001$), healthier (Elixhauser index 1.70 vs 1.95, $p < 0.001$), and more likely privately insured. RA-TKA was associated with shorter hospital stays (0.12 vs 0.77 days, $p < 0.001$) and significantly lower complication rates (1.4% vs 2.3%, p0.001), which persisted after multivariate adjustment (OR 0.68, 95% CI 0.53–0.87, p=0.002). No difference was observed in 90-day readmission rates (OR 0.93, 95% CI 0.73–1.19, p=0.57). Index hospitalization costs were higher for RA-TKA by approximately $903 (95% CI 670–1135, p0.001), but total 90-day episode-of-care costs were equivalent (p=0.78). Medicare beneficiaries were significantly less likely to receive robotic assistance (OR 0.49, p0.001).

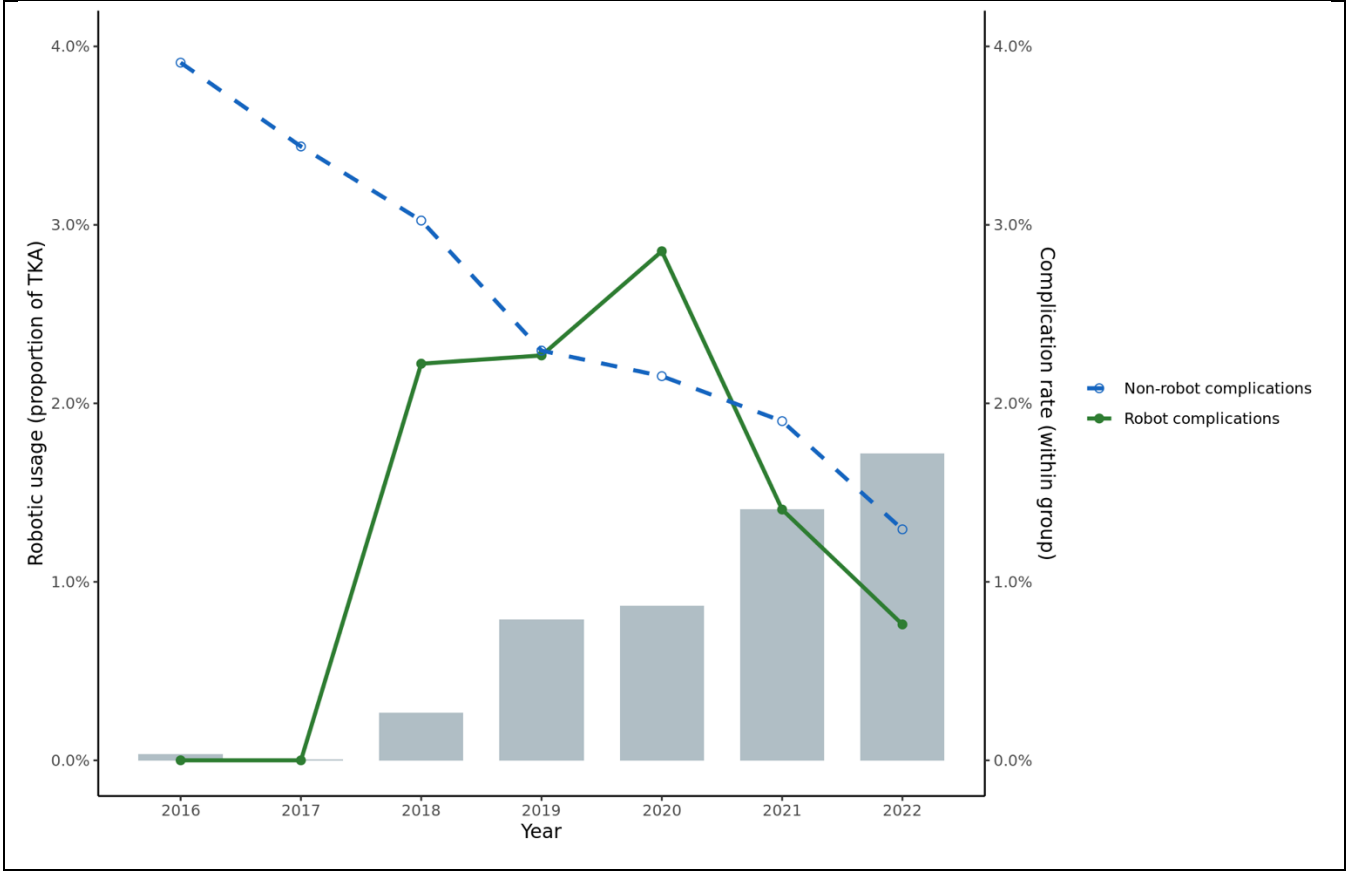
Conclusions: RA-TKA demonstrates improved short-term safety with lower complication rates and shorter hospital stays without increasing 90-day episode costs. Utilization remains concentrated among younger, healthier, privately insured patients, highlighting potential access disparities. These findings support the clinical and economic viability of robotic technology in contemporary arthroplasty practice.

Table 1. Demographics and Characteristics by Procedure Date in Individuals Undergoing Primary Total Knee Arthroplasty with Robotic and Non-Robotic Approaches (N=466,748)

Variable	Robotic (N=4,527)	Non-Robotic (N=462,221)	p-value
Age in years (Mean ± SE)	64.6 (0.14)	67.25 (0.01)	<0.001
Length of Stay (Mean ± SE)	0.12 (0.01)	0.77 (0.00)	<0.001
Elixhauser Comorbidity Index (Mean ± SE)	1.70 (0.02)	1.95 (<0.01)	<0.001
Index Cost	15458 (81.50)	14614 (11.76)	<0.001
90 Day Cost	1805 (101.99)	1776 (11.82)	0.78
Sex			<0.001
Female	2619 (0.58)	279564 (0.6)	
Male	1908 (0.42)	182657 (0.4)	
Race			<0.001
Asian	96 (0.02)	6603 (0.01)	
Black	470 (0.1)	40097 (0.09)	
Other	143 (0.03)	20755 (0.04)	
White	3818 (0.84)	394766 (0.85)	
Ethnicity			0.036

Hispanic	225 (0.05)	26378 (0.06)	
Non-Hispanic	4302 (0.95)	435843 (0.94)	
Payer			<0.001
Medicaid	240 (0.05)	18437 (0.04)	
Medicare	1922 (0.42)	285479 (0.62)	
Other	184 (0.04)	15202 (0.03)	
Private	2156 (0.48)	141365 (0.31)	
Uninsured	25 (0.01)	1738 (0)	
90 Day Readmission	69 (0.04)	11413 (0.05)	0.056
Complications	65 (0.01)	10450 (0.02)	<0.001
Column data reported as number of patients (%) or mean ± standard error (SE)			

Figure 1. Robotic TKA Usage and Complication Rates by Year (2016–2022)



(Following tables are for supplemental purposes only)

Supplemental Table 1. Multivariate Analyses for Association of Patient Level Factors and Robotic Surgery Designation in Individuals Undergoing Primary Total Knee Arthroplasty (N=466,748)			
Variable	**OR**	**CI**	**p-value**
Age in years (Unit of Change 10)	0.95	0.91-0.99	0.01
Sex			
Female	0.95	0.89-1.01	0.08
Male	Ref		
Race			
Asian	1.47	1.20-1.80	<0.001
Black	1.14	1.04-1.26	0.007
Other	0.68	0.58-0.81	<0.001
White	Ref		
Ethnicity			
Hispanic	0.91	0.79-1.04	0.16
Non Hispanic	Ref		
Payer			
Medicaid	0.87	0.76-1.00	0.05
Medicare	0.49	0.45-0.53	<0.001
Other	0.81	0.69-0.94	0.006
Private	Ref		
Uninsured	0.99	0.66-1.47	0.94
Elixhauser Comorbidity Index (Mean ± standard error)	0.91	0.89-0.93	<0.001

Supplemental Table 2. Multivariate Analyses for Effect of Robotic Assisted Procedure Designation on Complications in Individuals Undergoing Primary Total Knee Arthroplasty (N=466,748)			
Variable	**OR**	**CI**	**p-value**
Robot Assisted Procedure	0.68	0.53-0.87	0.002
Age in years (Unit of Change 10)	0.86	0.83-0.88	<0.001
Sex			
Female	0.69	0.66-0.72	<0.001
Male	Ref		
Race			
Asian	0.79	0.65-0.96	0.01
Black	0.94	0.87-1.00	0.06
Other	0.98	0.89-1.08	0.67

White	Ref		
Ethnicity			
Hispanic	1.06	0.98-1.12	0.17
Non Hispanic	Ref		
Payer			
Medicaid	1.83	1.67-1.99	<0.001
Medicare	1.40	1.32-1.48	<0.001
Other	1.20	1.07-1.34	0.001
Private	Ref		
Uninsured	1.31	0.96-1.80	0.01
Elixhauser Comorbidity Index (Mean ± standard error)	1.35	1.33-1.36	<0.001

Supplemental Table 3. Multivariate Analyses for Effect of Robotic Assisted Procedure Designation on 90 Day Readmission in Individuals Undergoing Primary Total Knee Arthroplasty (N=466,748)

Variable	OR	CI	p-value
Robot Assisted Procedure	**0.93**	**0.73-1.19**	**0.57**
Age in years (Unit of Change 10)	1.33	1.29-1.36	<0.001
Sex			
Female	0.75	0.72-0.78	<0.001
Male	Ref		
Race			
Asian	0.86	0.73-1.03	0.09
Black	1.18	1.11-1.26	<0.001
Other	1.07	0.97-1.17	0.16
White	Ref		
Ethnicity			
Hispanic	0.99	0.92-1.09	0.94
Non Hispanic	Ref		
Payer			
Medicaid	1.81	1.64-1.99	<0.001
Medicare	1.30	1.23-1.38	<0.001
Other	1.25	1.11-1.41	<0.001
Private	Ref		
Uninsured	1.20	0.85-1.70	0.29
Elixhauser Comorbidity Index (Mean ± standard error)	1.23	1.22-1.25	<0.001

Supplemental Table 4. Multivariate Analyses for Effect of Robotic Assisted Procedure Designation on Index Costs in Individuals Undergoing Primary Total Knee Arthroplasty (N=466,748)

Variable	CI	p-value	Estimate
Robot Assisted Procedure	**670.8-1135.7**	**<0.001**	**903.2**

Age in years (Unit of Change 10)	-9.7 - -56.1	0.17	23.2
Sex			
Female	-108.0 – -14.1	0.01	-61.0
Male	Ref		
Race			
Asian	2046.8 – 2430.5	<0.001	2238.7
Black	641.9 – 806.3	<0.001	724.1
Other	955.1 – 1184.3	<0.001	1069.7
White	Ref		
Ethnicity			
Hispanic	1780.8 – 1985.5	<0.001	1883.1
Non Hispanic	Ref		
Payer			
Medicaid	1007.5 – 1251.9	<0.001	1129.7
Medicare	-124.0 – 3.94	0.07	-60.0
Other	87.9 - 352.7	0.001	220.3
Private	Ref		
Uninsured	-428.8 – 317.3	0.77	-55.7
Elixhauser Comorbidity Index (Mean ± standard error)	320.3 – 352.1	<0.001	336.2