

Long-term cognitive decline after elective total joint arthroplasty: a population-based approach

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INTRO

- 31% of older adults undergoing elective total joint arthroplasty (TJA) meet criteria for postoperative neurocognitive disorder (NCD) a year after surgery (1), but population-level clinical significance of this is unknown.
- Understanding long-term cognitive outcomes after TJA will help us counsel patients about anticipated long-term risks and benefits.

METHODS

Participants:

- Health & Retirement Study participants age 65+ in fee-for-service Medicare 1998-2018
- 4 comparison groups: TJA recipients (N=1947), surgical controls (N=1631), nonsurgical controls (pain (N=1947) and no pain (N=1947))

Measurement:

- Memory score, a z-score-based summary measure of biennial HRS immediate and delayed word recall scores and proxy cognition reports, from time of surgery to three years after surgery

Primary outcome:

- Differences-in-differences (DiD) estimate of cognitive change from t=0 to t=3 years for the TJA group versus the surgical control group

Statistical analysis and modeling:

- Multivariable adjusted linear mixed effects model for memory score over time
- Restricted cubic splines with knots at t=-4, 0, 8 years, and a discontinuity at t=0 years

Cognitive trajectories in total joint arthroplasty recipients and surgical and nonsurgical controls are largely parallel throughout a 15-year analytic period.

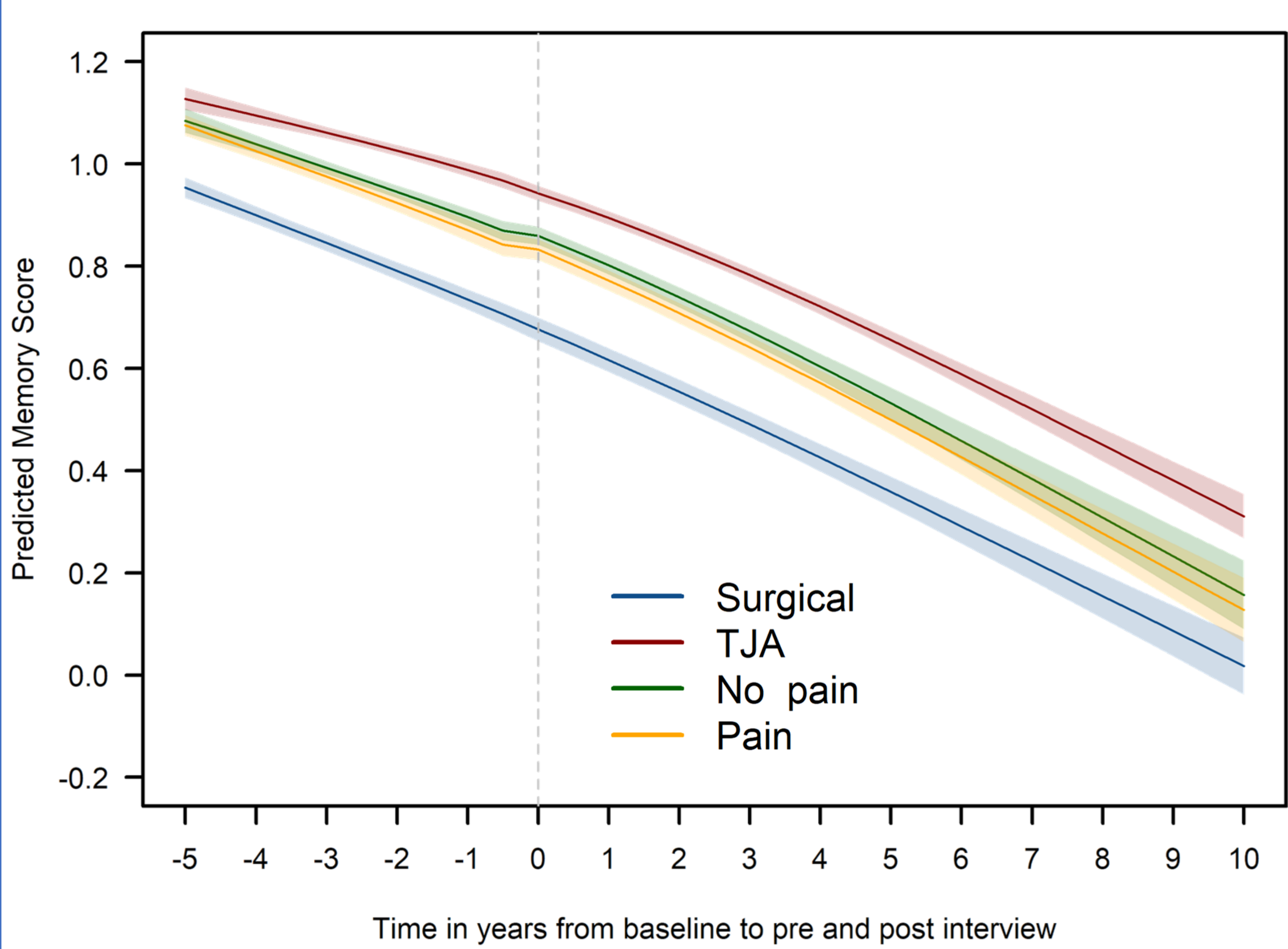


Figure 1: Population-level cognitive trajectory from 5 years before to 10 years after surgery or simulated procedure.

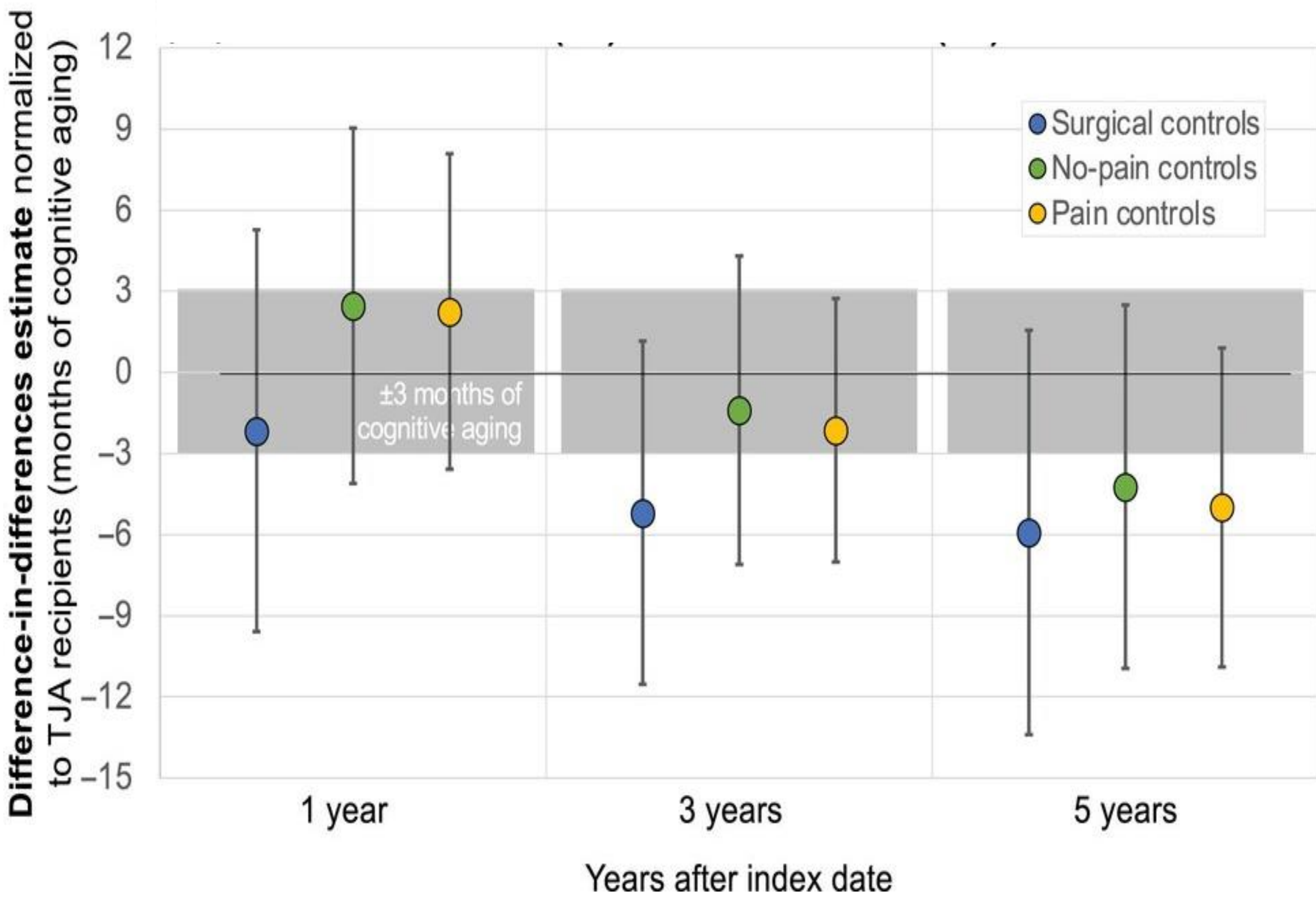


Figure 2: Difference-in-differences estimate for memory score change at 1, 3, and 5 years compared to TJA. The threshold of 3 months of cognitive change is used for clinical significance. Negative number implies better performance in the TJA group. Positive number implies poorer performance in the TJA group.

The measured 31% rate of neurocognitive disorder 1 year after total joint arthroplasty should be contextualized by the finding that, by 3 years, there is no evidence of average cognitive decline, and at 5 years, total joint arthroplasty may be compatible with cognitive improvement. (Figure 2)

Table 1: Group Demographics

		Procedure group				Total	p-value
		Surgical	TJA	No pain	Pain		
Demographic covariates:							
Age at procedure or index date		76.0 (7.9)	74.2 (6.4)	74.1 (6.6)	74.2 (6.5)	74.6 (6.8)	0.0000
Gender	Female	37.9%	62.6%	62.3%	63.1%	57.5%	<0.0001
	Male	62.1%	37.4%	37.7%	36.9%	42.5%	
Race/ethnicity	White	84.8%	88.8%	80.8%	79.5%	83.5%	<0.0001
	Black	7.2%	5.4%	10.2%	9.2%	8.0%	
	Hispanic	6.5%	4.1%	6.8%	8.7%	6.5%	
	Other	1.5%	1.7%	2.2%	2.7%	2.0%	
Highest education	<High school/GED	30.4%	19.4%	23.1%	32.0%	25.9	<0.0001
	High school	30.9%	34.0%	31.4%	31.3%	32.0	
	Some college	18.5%	21.3%	22.1%	21.7%	21.0	
	>College	20.2%	25.3%	23.4%	15.0%	21.0	
Health covariates:							
Hypertension		58.3%	63.0%	57.5%	67.0%	61.6%	<0.0001
Diabetes		20.5%	18.9%	20.6%	27.6%	21.9%	<0.0001
Depressive symptoms		23.6%	20.1%	15.1%	36.5%	23.7%	<0.0001
Cognitive status pre-procedure:							
Langa-Weir dementia status	Normal	70.8%	84.4%	78.3%	72.8%	77.0%	0.0000
	CIND	21.8%	13.8%	15.8%	21.0%	17.9%	
	Dementia	7.4%	1.8%	5.9%	6.2%	5.2%	
Memory score at pre-procedure interview:		0.74 (0.61)	0.99 (0.42)	0.90 (0.54)	0.86 (0.54)	0.88 (0.50)	0.0009

Clinical significance:

- No established clinical significance threshold for population-average cognitive change
- 1-2 standard deviation (SD) decline in cognition in individuals is considered clinically significant
- In this study, we defined the clinical significance threshold as 3 months of average cognitive change

RESULTS

- DiD estimate between TJA and control groups at 3 years post-procedure:
 - vs Surgical: 0.024 [-0.005 to 0.052] memory units
 - vs No Pain: 0.006 [-0.020 to 0.032] memory units
 - vs Pain : 0.010 [-0.012 to 0.032] memory units

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