

Online Supplementary Material

Ament JD, Vokshoor A, Badr Y, et al. A prospective study of lumbar facet arthroplasty in the treatment of degenerative spondylolisthesis and stenosis: early cost-effective assessment from the Total Posterior Spine System (TOPS™) IDE Study. *JHEOR*. 2022;9(1):82-89. [doi:10.36469/jheor.2022.33035](https://doi.org/10.36469/jheor.2022.33035)

Figure S1: Mapping of Health States

Figure S2: Markov Schematic

Figure S3: One-way Sensitivity Analysis Results: Costs of TOPS™ vs Control

Figure S4: One-way Sensitivity Analysis Results: Effect of TOPS™ vs Control

Figure S5: One-way Sensitivity Analysis Results: Incremental Cost-effectiveness Ratio of TOPS™ vs Control

Table S1: TOPS™ Transition Probabilities

Table S2: TLIF Transition Probabilities

Table S3: Productivity Loss Category Probabilities by Time Point

Table S4: Average Medication Costs by Health State per Individual

Table S5: Net Monetary Benefit, Both Perspectives

Table S6: Cost-Effectiveness of TOPS™ vs TLIF in Alternative Scenarios

This supplementary material has been provided by the authors to give readers additional information about their work.



Figure S1. Mapping of Health States

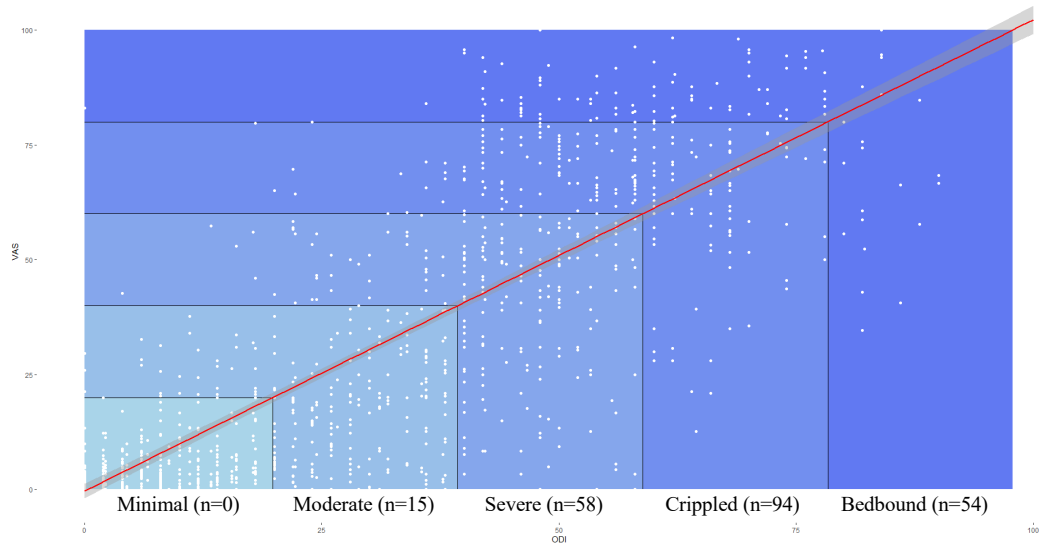
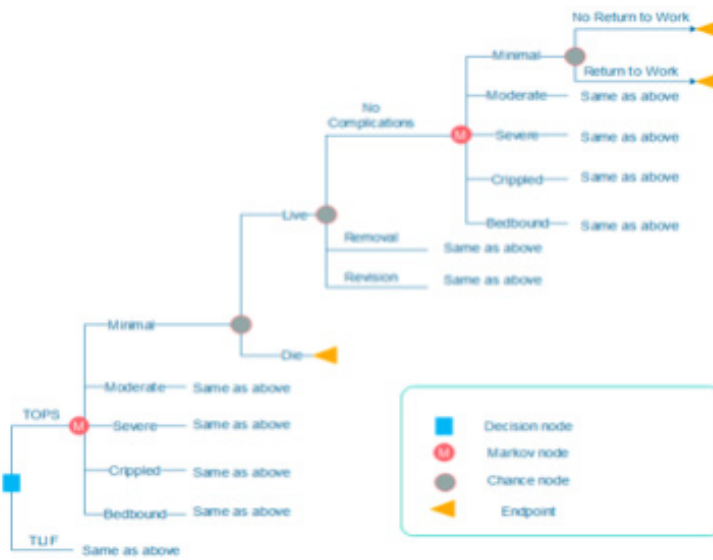
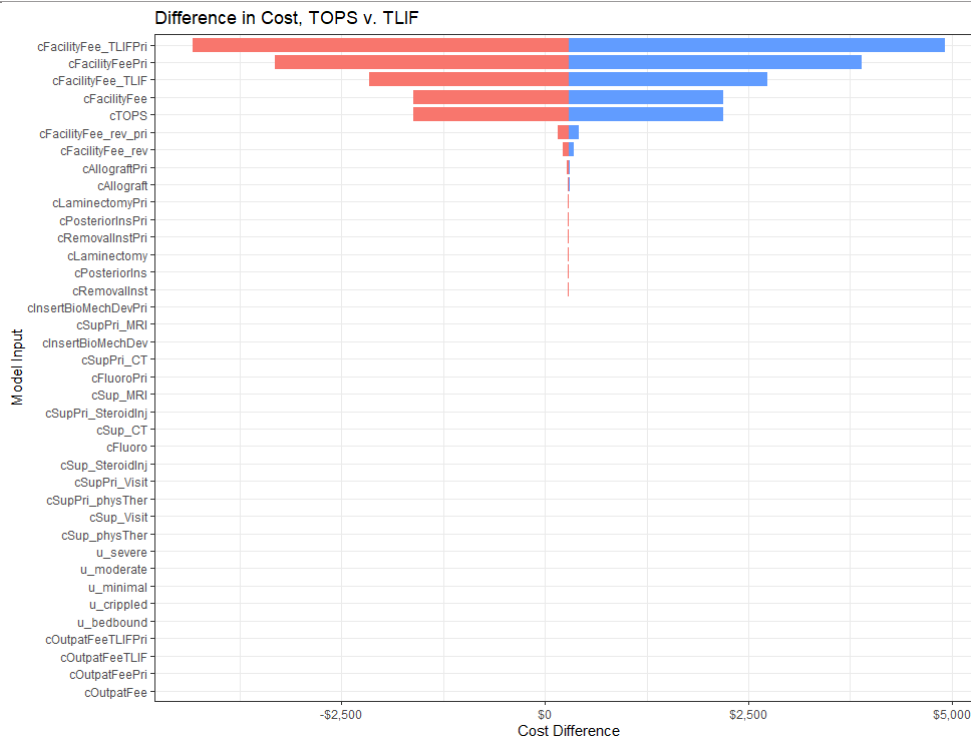


Figure S2. Markov Schematic



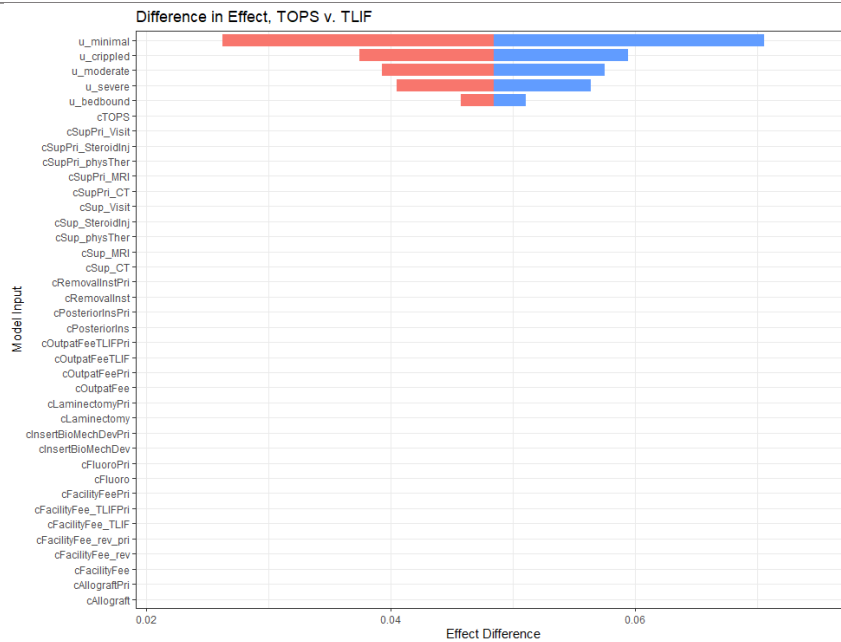
Abbreviation: TLIF, transformational lumbar interbody fusion.

Figure S3. One-way Sensitivity Analysis Results: Costs of TOPS™ vs Control



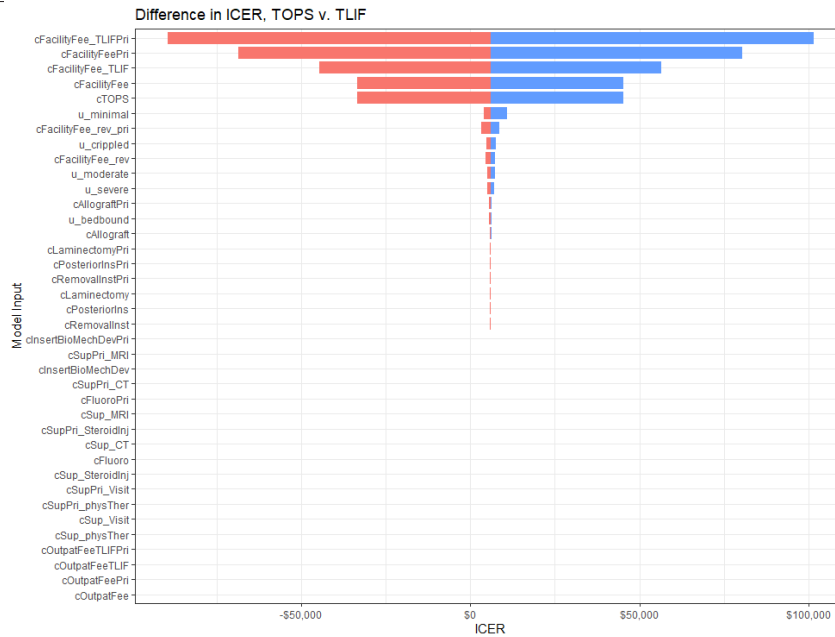
Abbreviation: TLIF, transformational lumbar interbody fusion.

Figure S4. One-way Sensitivity Analysis Results: Effect of TOPS™ vs Control



Abbreviation: TLIF, transformational lumbar interbody fusion.

Figure S5. One-way Sensitivity Analysis Results: Effect of TOPS™ vs Control



Abbreviation: TLIF, transformational lumbar interbody fusion.

Table S1. TOPS™ Transition Probabilities

From Health State	Transit to Health State					Time Range
	Minimal	Moderate	Severe	Crippled	Bedbound	
Minimal	1.000	0.000	0.000	0.000	0.000	Surgery-6W
	0.889	0.081	0.030	0.000	0.000	6W-3M
	0.891	0.076	0.033	0.000	0.000	3M-6M
	0.929	0.043	0.014	0.014	0.000	6M-12M
	0.947	0.053	0.000	0.000	0.000	12M-24M+
Moderate	1.000	0.000	0.000	0.000	0.000	Surgery-6W
	0.522	0.348	0.130	0.000	0.000	6W-3M
	0.500	0.350	0.100	0.050	0.000	3M-6M
	0.444	0.278	0.167	0.111	0.000	6M-12M
	0.333	0.333	0.167	0.167	0.000	12M-24M+
Severe	0.775	0.225	0.000	0.000	0.000	Surgery-6W
	0.000	0.625	0.250	0.125	0.000	6W-3M
	0.125	0.500	0.125	0.250	0.000	3M-6M
	0.000	1.000	0.000	0.000	0.000	6M-12M
	0.333	0.333	0.333	0.000	0.000	12M-24M+
Crippled	0.729	0.186	0.085	0.000	0.000	Surgery-6W
	0.000	0.000	1.000	0.000	0.000	6W-3M
	0.000	1.000	0.000	0.000	0.000	3M-6M
	0.000	0.000	0.500	0.500	0.000	6M-12M
	0.000	0.000	1.000	0.000	0.000	12M-24M+
Bedbound	0.758	0.091	0.091	0.061	0.000	Surgery-6W
	0.000	0.000	0.000	0.000	1.000	6W-3M
	0.000	0.000	0.000	0.000	1.000	3M-6M
	0.000	0.000	0.000	0.000	1.000	6M-12M
	0.000	0.000	0.000	0.000	1.000	12M-24M+

Abbreviations: M, months; W, weeks.

Table S2. TLIF Transition Probabilities

From Health State	Transit to Health State					Time Range
	Minimal	Moderate	Severe	Crippled	Bedbound	
Minimal	1.000	0.000	0.000	0.000	0.000	Surgery-6W
	0.919	0.054	0.027	0.000	0.000	6W-3M
	0.868	0.026	0.079	0.000	0.026	3M-6M
	0.846	0.115	0.038	0.000	0.000	6M-12M
	0.929	0.000	0.000	0.071	0.000	12M-24M+
Moderate	0.714	0.143	0.143	0.000	0.000	Surgery-6W
	0.692	0.231	0.077	0.000	0.000	6W-3M
	0.600	0.200	0.200	0.000	0.000	3M-6M
	0.250	0.250	0.500	0.000	0.000	6M-12M
	0.000	0.000	0.000	1.000	0.000	12M-24M+
Severe	0.647	0.294	0.059	0.000	0.000	Surgery-6W
	0.000	0.000	0.800	0.200	0.000	6W-3M
	0.200	0.600	0.000	0.000	0.200	3M-6M
	0.500	0.000	0.500	0.000	0.000	6M-12M
	0.000	0.000	0.000	1.000	0.000	12M-24M+
Crippled	0.643	0.179	0.036	0.107	0.036	Surgery-6W
	0.000	0.333	0.000	0.667	0.000	6W-3M
	0.000	0.500	0.000	0.500	0.000	3M-6M
	0.000	0.000	0.000	1.000	0.000	6M-12M
	0.000	0.000	0.000	1.000	0.000	12M-24M+
Bedbound	0.467	0.333	0.133	0.000	0.067	Surgery-6W
	0.500	0.000	0.000	0.500	0.000	6W-3M
	0.000	0.000	0.000	0.000	1.000	3M-6M
	1.000	0.000	0.000	0.000	0.000	6M-12M
	0.000	0.000	0.000	0.000	1.000	12M-24M+

Abbreviations: M, months; TLIF, transformational lumbar interbody fusion; W, weeks.

Table S3. Productivity Loss Category Probabilities by Time Point

Parameter	Period	Value	
1. Work without restriction		TLIF	TOPS™
Minimal	All time	93.94%	95.74%
Moderate	All time	60.00%	60.78%
Severe	All time	23.81%	23.40%
Crippled	All time	10.00%	8.89%
Bedbound	All time	6.25%	0.00%
2. Unable to work		TLIF	TOPS™
Minimal	All time	6.06%	3.88%
Moderate	All time	30.00%	33.33%
Severe	All time	23.81%	17.02%
Crippled	All time	15.00%	2.22%
Bedbound	All time	6.25%	3.23%
3. Work N/A		TLIF	TOPS™
Minimal	All time	0.00%	0.39%
Moderate	All time	10.00%	5.88%
Severe	All time	52.38%	59.57%
Crippled	All time	75.00%	88.89%
Bedbound	All time	87.50%	96.77%

Abbreviation: TLIF, transformational lumbar interbody fusion.

Table S4. Average Medication Costs by Health State per Individual

Period/Parameter	Value		Source
Surgery-6W	TLIF	TOPS™	
Minimal			
Moderate			
Severe	\$149	\$121	
Crippled			
Bedbound			
6W+			RCT
Minimal	\$0	\$76	
Moderate	\$55	\$58	
Severe	\$50	\$72	
Crippled	\$55	\$134	
Bedbound	\$0	\$12	

Abbreviations: RCT, randomized controlled trial; TLIF, transformational lumbar interbody fusion; W, weeks.

Table S5. Net Monetary Benefit, Both Perspectives

	Time Horizon	TOPS™		Control		NMB, Based on 3 WTP Thresholds ^b		
		Cost ^a	QALY	Cost	QALY	WTP=\$50 000	WTP=\$100 000	WTP=\$150 000
Health systems	90-day	\$41 513.08	0.1759	\$40 031.79	0.1697	-\$1168.00	-\$854.71	-\$541.42
	1-year	\$43 444.75	0.7171	\$42 408.64	0.7003	-\$193.00	\$650.11	\$1493.22
	2-year	\$44 762.57	1.4142	\$44 461.65	1.3653	\$2142.46	\$4585.85	\$7029.23
	6-year	\$49 348.65	4.0382	\$56 075.82	3.6848	\$24 395.90	\$42 064.63	\$59 733.37
	10-year	\$53 320.47	6.3865	\$68 867.20	5.6009	\$54 826.89	\$94 107.05	\$133 387.21
Societal	90-day	\$41 768.70	0.1759	\$40 419.30	0.1697	-\$1036.10	-\$722.81	-\$409.52
	1-year	\$45 169.82	0.7171	\$44 741.92	0.7003	\$415.20	\$1258.31	\$2101.42
	2-year	\$48 329.80	1.4142	\$50 162.08	1.3653	\$4275.66	\$6719.05	\$9162.43
	6-year	\$58 608.36	4.0382	\$81 771.23	3.6848	\$40 831.60	\$58 500.34	\$76 169.07
	10-year	\$67 074.61	6.3865	\$118 371.24	5.6009	\$90 576.79	\$129 856.95	\$169 137.11

Abbreviations: NMB, net monetary benefit; QALY, quality-adjusted life-year; WTP, willingness-to-pay.

^a Includes TOPS™ cost in the initial surgery.

^b NMB = Δ QALY *WTP threshold - Δ Cost.

Table S6. Cost-effectiveness of TOPS™ vs TLIF in Alternative Scenarios

Scenario	TOPS™		TLIF		Difference		Results		Net Monetary Benefit			
	Time point	Cost	Utilities	Cost	Utilities	Cost	Utilities	ICER	Status	\$50,000	\$100,000	\$150,000
1. Health systems 50/50 insurance inpatient (base case)	3-month	\$41 513.08	0.1759	\$40 031.79	0.1697	\$1481	0.0063	\$236 407	Undominated	-\$1168.00	-\$854.71	-\$541.42
	1-year	\$43 444.75	0.7171	\$42 408.64	0.7003	\$1036	0.0169	\$61 446	Undominated	-\$193.00	\$650.11	\$1493.22
	2-year	\$44 762.57	1.4142	\$44 461.65	1.3653	\$301	0.0489	\$6158	Undominated	\$2142.46	\$4585.85	\$7029.23
	6-year	\$49 348.65	4.0382	\$56 075.82	3.6848	-\$6727	0.3534	-\$19 037	Dominant	\$24 395.90	\$42 064.63	\$59 733.37
	10-year	\$53 320.47	6.3865	\$68 867.20	5.6009	-\$15 547	0.7856	-\$19 790	Dominant	\$54 826.89	\$94 107.05	\$133 387.21
2. Societal 50/50 insurance inpatient (base case)	3-month	\$41 768.70	0.1759	\$40 419.30	0.1697	\$1349	0.0063	\$215 357	Undominated	-\$1036.10	-\$722.81	-\$409.52
	1-year	\$45 169.82	0.7171	\$44 741.92	0.7003	\$428	0.0169	\$25 377	Undominated	\$415.20	\$1258.31	\$2101.42
	2-year	\$48 329.80	1.4142	\$50 162.08	1.3653	-\$1832	0.0489	-\$37 495	Dominant	\$4275.66	\$6719.05	\$9162.43
	6-year	\$58 608.36	4.0382	\$81 771.23	3.6848	-\$23 163	0.3534	-\$65 548	Dominant	\$40 831.60	\$58 500.34	\$76 169.07
	10-year	\$67 074.61	6.3865	\$118 371.24	5.6009	-\$51 297	0.7856	-\$65 296	Dominant	\$90 576.79	\$129 856.95	\$169 137.11
3. Health systems 100% Medicare inpatient	3-month	\$31 721.58	0.1759	\$27 782.30	0.1697	\$3939	0.0063	\$628 690	Undominated	-\$3625.98	-\$3312.69	-\$2999.40
	1-year	\$33 393.56	0.7171	\$29 815.58	0.7003	\$3578	0.0169	\$212 190	Undominated	-\$2734.87	-\$1891.76	-\$1048.66
	2-year	\$34 579.61	1.4142	\$31 596.46	1.3653	\$2983	0.0489	\$61 046	Undominated	-\$539.77	\$1903.62	\$4347.00
	6-year	\$38 731.64	4.0382	\$41 417.04	3.6848	-\$2685	0.3534	-\$7599	Dominant	\$20 354.13	\$38 022.86	\$55 691.59
	10-year	\$42 332.92	6.3865	\$52 146.70	5.6009	-\$9814	0.7856	-\$12 492	Dominant	\$49 093.94	\$88 374.10	\$127 654.25
4. Health systems 100% private inpatient	3-month	\$51 304.59	0.1759	\$52 281.28	0.1697	-\$977	0.0063	-\$155 875	Dominant	\$1289.98	\$1603.28	\$1916.57
	1-year	\$53 495.93	0.7171	\$55 001.69	0.7003	-\$1506	0.0169	-\$89 298	Dominant	\$2348.87	\$3191.98	\$4035.09
	2-year	\$54 945.53	1.4142	\$57 326.85	1.3653	-\$2381	0.0489	-\$48 730	Dominant	\$4824.70	\$7268.08	\$9711.47
	6-year	\$59 965.67	4.0382	\$70 734.61	3.6848	-\$10 769	0.3534	-\$30 475	Dominant	\$28 437.67	\$46 106.41	\$63 775.14
	10-year	\$64 308.01	6.3865	\$85 587.70	5.6009	-\$21 280	0.7856	-\$27 087	Dominant	\$60 559.85	\$99 840.01	\$139 120.17
5. Health systems 50/50 insurance outpatient	3-month	\$32 553.08	0.1759	\$23 111.29	0.1697	\$9442	0.0063	\$1 506 866	Undominated	-\$9128.50	-\$8815.21	-\$8501.92
	1-year	\$34 484.75	0.7171	\$25 488.14	0.7003	\$8997	0.0169	\$533 538	Undominated	-\$8153.50	-\$7310.39	-\$6467.28
	2-year	\$35 802.57	1.4142	\$27 541.15	1.3653	\$8261	0.0489	\$169 057	Undominated	-\$5818.04	-\$3374.65	-\$931.27
	6-year	\$40 388.65	4.0382	\$39 155.32	3.6848	\$1233	0.3534	\$3490	Undominated	\$16 435.40	\$34 104.13	\$51 772.87
	10-year	\$44 360.47	6.3865	\$51 946.70	5.6009	-\$7586	0.7856	-\$9657	Dominant	\$46 866.39	\$86 146.55	\$125 426.71

	Time point	Cost	Utilities	Cost	Utilities	Cost	Utilities	ICER	Status	\$50 000	\$100 000	\$150 000
6. Health systems 50/50 insurance 50/50	3-month	\$37 033.08	0.1759	\$31 571.54	0.1697	\$5462	0.0063	\$871 637	Undominated	-\$5148.25	-\$4834.96	-\$4521.67
	1-year	\$38 964.75	0.7171	\$33 948.39	0.7003	\$5016	0.0169	\$297 492	Undominated	-\$4173.25	-\$3330.14	-\$2487.03
	2-year	\$40 282.57	1.4142	\$36 001.40	1.3653	\$4281	0.0489	\$87 607	Undominated	-\$1837.79	\$605.60	\$3048.98
	6-year	\$44 868.65	4.0382	\$47 615.57	3.6848	-\$2747	0.3534	-\$7773	Dominant	\$20 415.65	\$38 084.38	\$55 753.12
	10-year	\$48 840.47	6.3865	\$60 406.95	5.6009	-\$11 566	0.7856	-\$14 723	Dominant	\$50 846.64	\$90 126.80	\$129 406.96
7. Health systems 100% Medicare outpatient	3-month	\$25 700.58	0.1759	\$16 252.30	0.1697	\$9448	0.0063	\$1 507 901	Undominated	-\$9134.98	-\$8821.69	-\$8508.40
	1-year	\$27 372.56	0.7171	\$18 285.58	0.7003	\$9087	0.0169	\$538 897	Undominated	-\$8243.87	-\$7400.76	-\$6557.66
	2-year	\$28 558.61	1.4142	\$20 066.46	1.3653	\$8492	0.0489	\$173 778	Undominated	-\$6048.77	-\$3605.38	-\$1162.00
	6-year	\$32 710.64	4.0382	\$29 887.04	3.6848	\$2824	0.3534	\$7990	Undominated	\$14 845.13	\$32 513.86	\$50 182.59
	10-year	\$36 311.92	6.3865	\$40 616.70	5.6009	-\$4305	0.7856	-\$5480	Dominant	\$43 584.94	\$82 865.10	\$122 145.25
8. Health systems 100% private outpatient	3-month	\$39 405.59	0.1759	\$29 970.28	0.1697	\$9435	0.0063	\$1 505 832	Undominated	-\$9122.02	-\$8808.72	-\$8495.43
	1-year	\$41 596.93	0.7171	\$32 690.69	0.7003	\$8906	0.0169	\$528 178	Undominated	-\$8063.13	-\$7220.02	-\$6376.91
	2-year	\$43 046.53	1.4142	\$35 015.85	1.3653	\$8031	0.0489	\$164 335	Undominated	-\$5587.30	-\$3143.92	-\$700.53
	6-year	\$48 066.67	4.0382	\$48 423.61	3.6848	-\$357	0.3534	-\$1010	Dominant	\$18 025.67	\$35 694.41	\$53 363.14
	10-year	\$52 409.01	6.3865	\$63 276.70	5.6009	-\$10 868	0.7856	-\$13 834	Dominant	\$50 147.85	\$89 428.01	\$128 708.17

Abbreviations: ICER, incremental cost-effectiveness ratio; NMB, net monetary benefit; TLIP, transformational lumbar interbody fusion.

a $\Delta\text{Cost} = \text{TOPS cost} - \text{Control Cost}$.

b $\Delta\text{QALY} = \text{TOPS QALY} - \text{Control QALY}$.

c $\text{ICER} = \Delta\text{Cost} / \Delta\text{QALY}$; "Dominant" indicates that TOPS costs less while yielding a higher QALY.

d $\text{NMB} = \Delta\text{QALY} * \text{WTP threshold} - \Delta\text{Cost}$.