

Innovative Technologies: Measuring the Value

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Adult and Pediatric

Spine and Scoliosis

Surgery

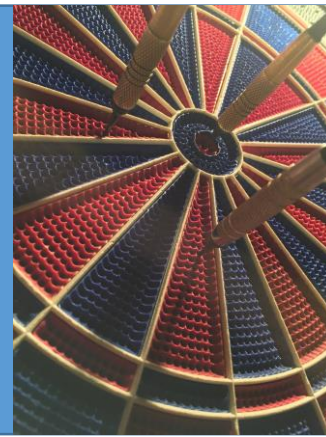
Overview

- What Defines Value?
- How is Value measured differently by stakeholders?
- How is cost measured?
- Example of value difference for one spinal technology.





Accuracy vs Precision



- **Berven: Quality vs Value**
- **Quality of care** is measured by standardized processes of care, and a rate of compliance with those processes. Quality measures may include the presence of an **electronic medical record**, **nurse-to-patient ratios**, and rates of **adherence to established perioperative protocols**.
- **Value of care** is measured by an analysis of the **patient's self-assessment of the benefit of care over time relative to the cost of that benefit**. An accurate assessment of the value of a specific intervention should account for the incremental benefit and cost of care compared to the alternative.

Words are Important!

What is Value?

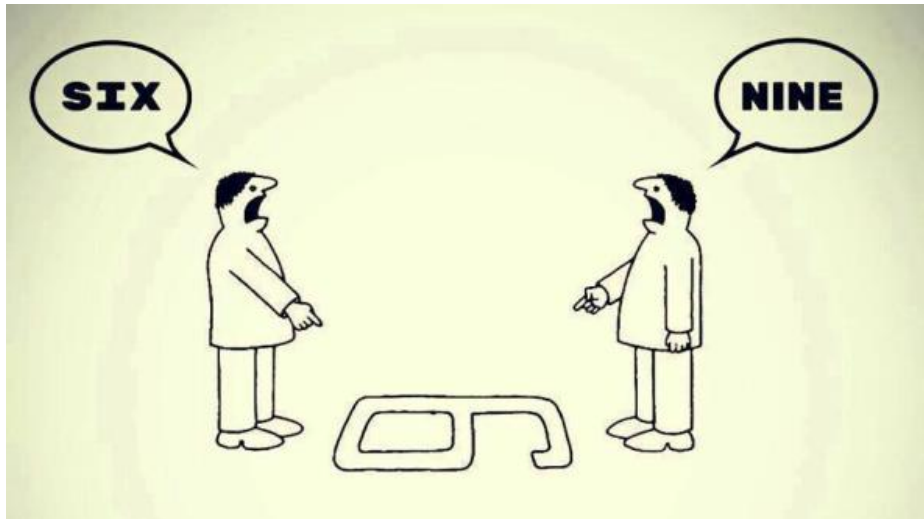
- The **value proposition** in health care is an analysis of the **benefits** of care relative to the direct (*and indirect*) **cost** and **risk of providing the care**.
- Measurement of benefits and costs is challenging, and **a consensus on the measures that encompass the relevant components of the value equation has not been reached**.



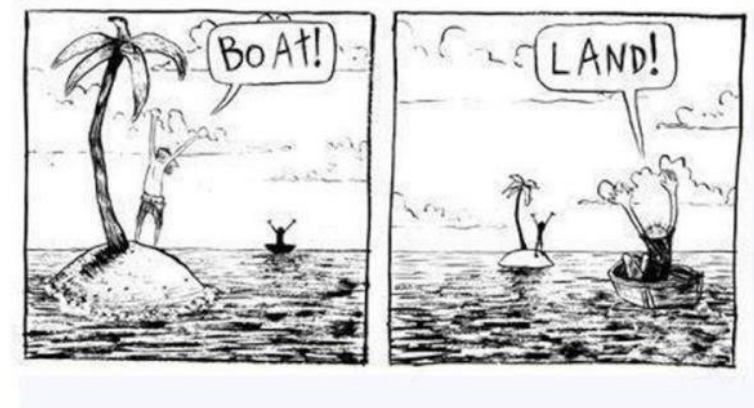
Who is paying?

<https://www.healio.com/orthopedics/spine/news/print/orthopedics-today/%7Bb1cc38c3-2b9c-4dfc-84a9-44f5049e46c1%7D/how-should-value-be-defined-in-spine-surgery>

Value



Cost



Perspective...

What is life worth?



VALUE

- 43 yrs old
- Hope to Live 40 more years
- Get diagnosed with rare disease
- Would you be willing to pay \$1 Million for an intervention?
- Would calculate to \$25 thousand for each year of life gained? Is that really a lot?

25 K/quality life year

Utility Score – How we measure in between..

- Value Between 0 and 1
 - 0 dead
 - 1 Perfect health
 - Can be negative ...wish you were dead

Standard Gamble-

Would you risk your life to be better?



1

VS



0

Pedicle Subtraction Osteotomy



Complications	<i>n</i> (%)
Major (<3 mo)	14 (21.5)
Neurologic deficit	4 (6.2)
Deep wound infection	3 (4.6)
Myocardial infarction	1 (1.5)
Pneumonia	2 (3)
Respiratory distress syndrome	1 (1.5)
Perioperative death	3 (4.6)



How do Surgeons Measure Benefits/Outcomes



- Traditional outcome measures in orthopedics including survival, radiographic outcomes, and disease-specific outcome tools do not adequately reflect the patient's health care experience, or the impact of an intervention on [health-related quality of life](#).

Process Based
VS
Patient Reported
outcomes



More than Just Surgeon...

- Similarly, measuring cost of care is complex, and may encompass both **direct costs of treatment** and **alternative treatments**, and **indirect costs** including time from work or family role, loss of productivity, and cost of caretakers.

Measure Cost



Patient Reported Outcomes

- patient-reported outcome (PRO) measures where patients self-report via questionnaires.
 - general quality of life
 - pain scale
 - disease-specific outcome measures
- May also be considered as a utility scores
 - Adjustable to different beliefs and societies
 - **This is an indirect measure of a Utility Score**

J Am Acad Orthop Surg. 2013 Feb;21(2):99-107. doi: 10.5435/JAAOS-21-02-99.

Table 1

Selected Outcome Measures

General quality of life

Short Form questionnaires (-6, -12, -36)

EuroQol Five Dimension questionnaire

Pain

Visual analog scale

Numeric rating scale

Lumbar-specific

Oswestry Disability Index

Roland Morris Disability Questionnaire

Quebec Back Scale

Cervical-specific

Neck Disability Index

Cervical Spine Outcomes Questionnaire

Myelopathy

Japanese Orthopaedic Association
Myelopathy Scale (original and modified versions)

Myelopathic Disability Index

Confusion

- Hospital- and payor-based **quality measures** may be misinterpreted as measures of outcome or value.

process measures

- Length of stay
- surgical times
- compliance with antibiotic or thromboembolic prophylaxis
- perioperative complications

May be useful to compare hospital and provider performance when appropriately matched and stratified

Confusion –Quality for the Carrier or Hospital

- Not useful in measuring a patient’s health care experience, or the impact of an intervention on long-term health-related quality of life.
- “In fact, a focus on quality and process measures alone may be **misleading** in the pursuit of value in health care, and may provide incentive for counterproductive care strategies that serve the measurement system rather than the patient.”
- Hospital Costs do reflect value!!
 - Implant cost
 - Length of stay



QALY

- The quality-adjusted life year (QALY) is the most widely **used/discussed** effectiveness measure that combines length and quality of life into a single number.
- QALYs are typically estimated by multiplying the amount of time spent in each health state by each state's health utility and summing up.

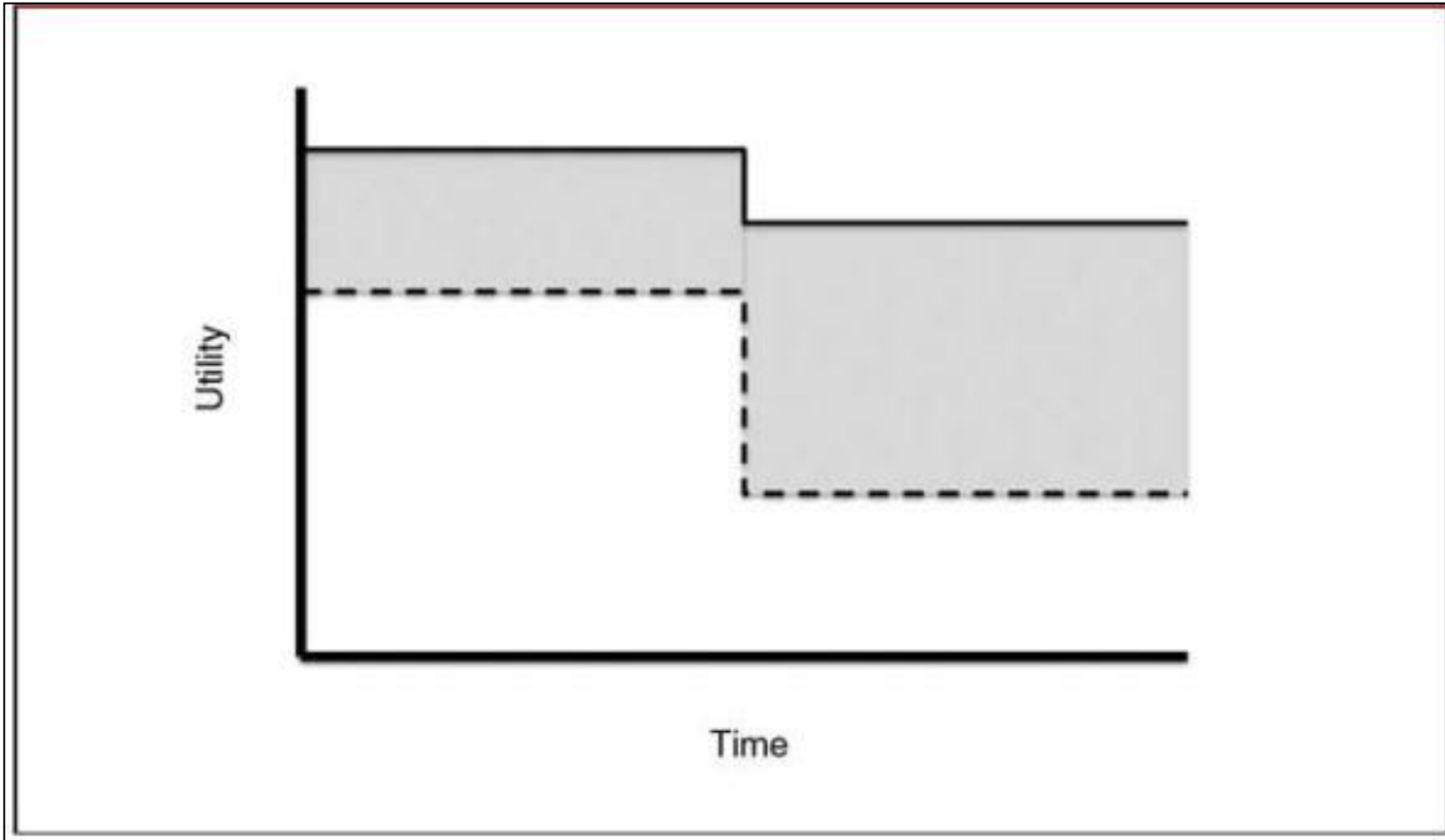
Example

5 years in perfect health (Utility Value of 1)

3 years with limited mobility (Utility Value of 0.85)

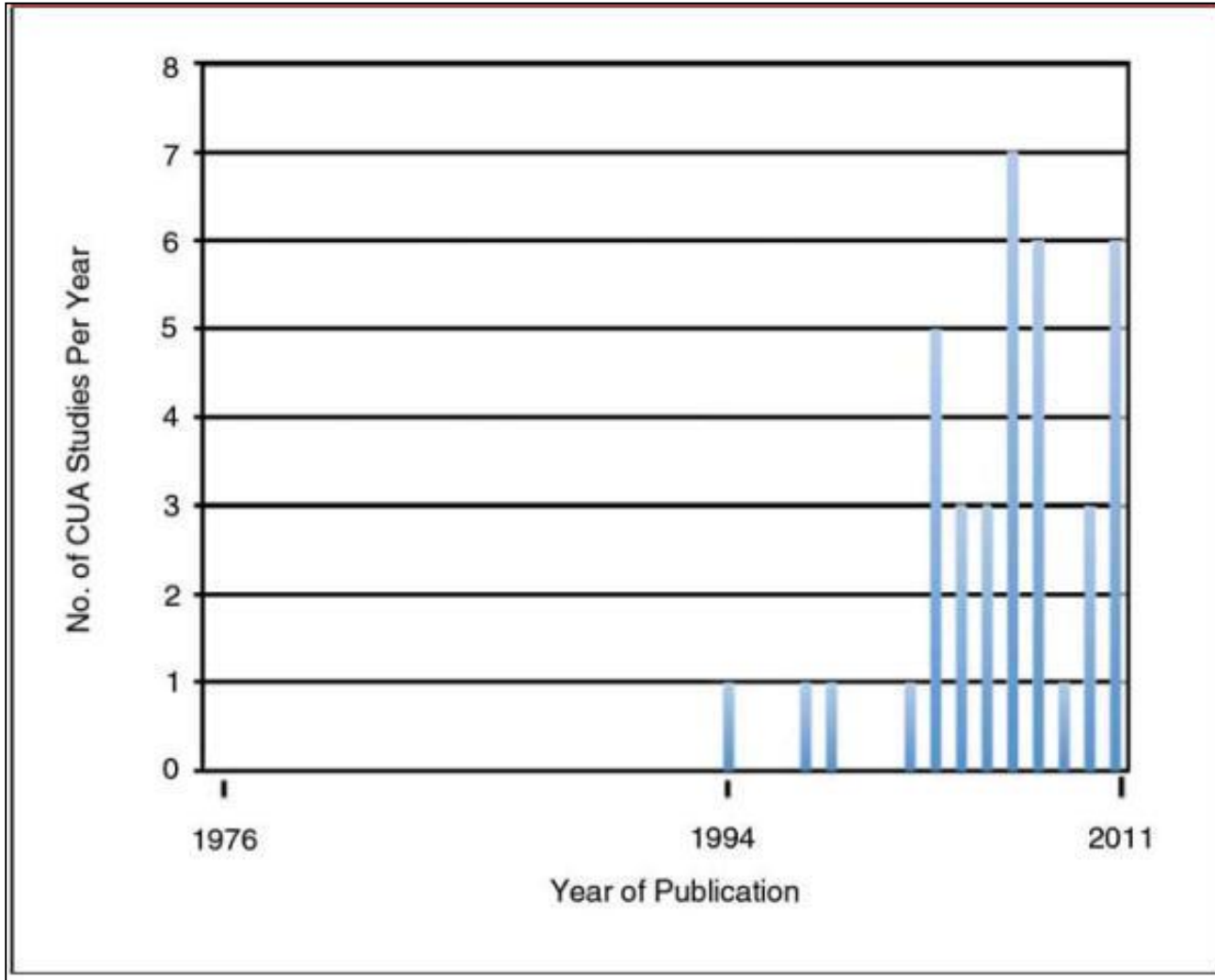
2 years with limited mobility and moderate pain (Utility Value of 0.70)

Total Value for 10 years = 8.95 QALYs (5x1 + 3x0.85 + 2x0.7=8.95)



Graphic representation of the utility provided by any two separate treatments for any condition over time. The quality-adjusted life years gained by treatment 1 (solid line) compared with treatment 2 (dashed line) are represented by the shaded area. This is a general depiction and is not specific to lumbar stenosis.

Spine-related cost-utility analysis (CUA)

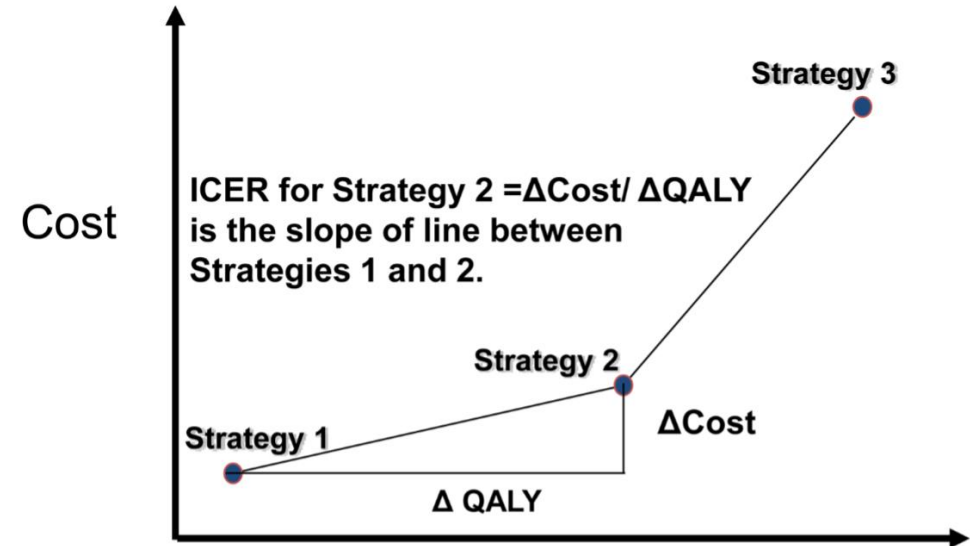


- Graphic representation of the number of spine-related cost-utility analysis (CUA) studies published per year between 1976 and 2011.
- These data were compiled based on a search of the Tufts Medical Center Cost-Effectiveness Analysis Registry (<https://research.tufts-nemc.org/cear4>) using the keyword "spine" on September 12, 2012.

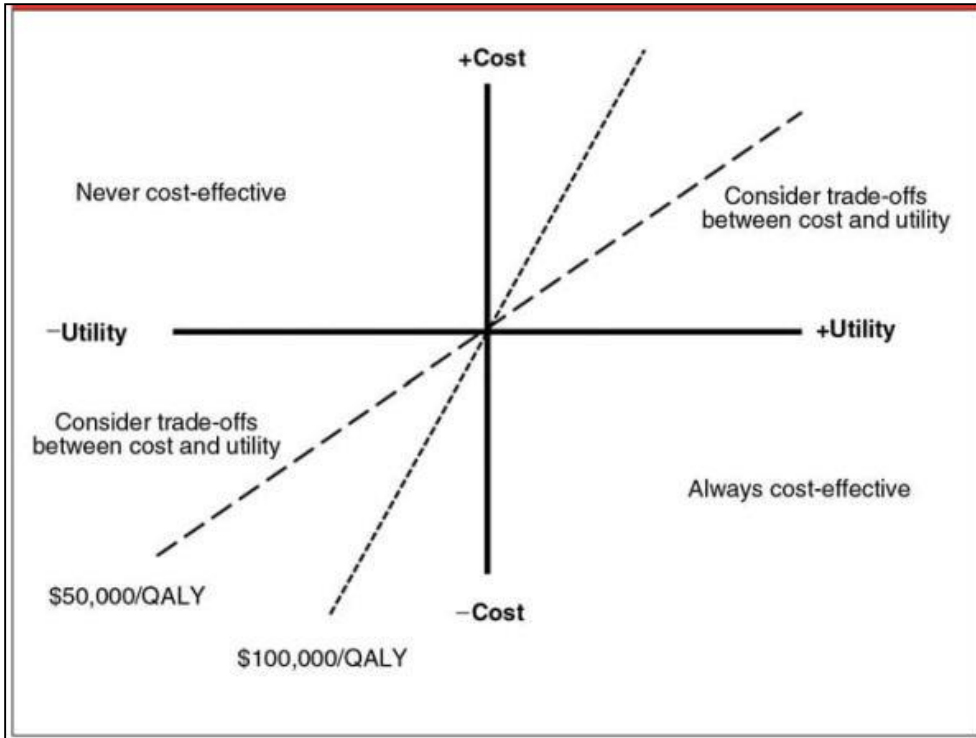
Incremental cost-effectiveness ratio (ICER)

- The ICER is defined as the change in cost divided by the change in effectiveness for each more costly alternative when they are ranked from lowest to highest cost
- When the costs of alternative care strategies are plotted against their estimated effectiveness, the slope of the line between strategies is the ICER.

$$\text{ICER} = \frac{\text{Cost Tx 1} - \text{Cost Tx 2}}{\text{QALY Tx 1} - \text{QALY Tx 2}}$$



Comparison of Interventions



- 4 possible cost-effectiveness quadrants of an intervention based on the cost and utility of the intervention.
- Interventions that fall into the upper left quadrant are never cost-effective.
- Those that fall into the lower right quadrant are always cost-effective. Interventions that fall into the upper right or lower left quadrants, the willingness-to-pay threshold of the payer must be considered.
- Any intervention that falls to the right of the lines indicating \$50,000 per quality-adjusted life year (QALY) and \$100,000 per QALY would be considered cost-effective according to that particular willingness-to-pay threshold.

Whose Values are Important

- While it is widely accepted that the individual patient's preferences and health utilities should guide his or her decision making, when assessing the cost-effectiveness of healthcare interventions, it is societal preferences for health outcomes rather than the preferences of those directly affected that are considered appropriate



I want a fusion!



I want a fusion!

Angevine and McCormick ACDF Model.

- Assume no significant long term differences in outcome between the ACDF and ACDF plus plate (ACDFP) groups.
- ACDFP procedure was associated with a higher cost (the plate and its application cost approximately \$1500 at their center).
- From a payer perspective then, it would seem that ACDF without plate would be the procedure with higher value-same outcome at a lower price



What about the patient and society?

- ACDFP go back to work on average **3 weeks sooner** than those treated with ACDF.
- It is assumed that this difference is due to the surgeon's practice of requiring patients without plate fixation to wear a cervical collar for a period of time following the operation, **prohibiting driving and work in most cases.**



What is your time worth?

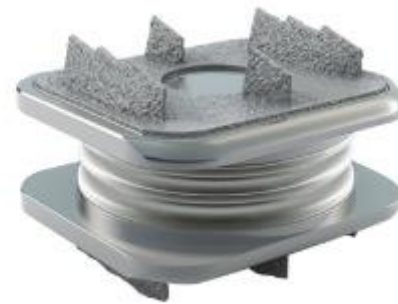
- If the lost income in those three weeks is more than \$1500, then from a patient perspective, the ACDFP is the procedure with more “value.”
- Similarly, if the patient is able to produce more than \$1500 in goods and or services during those three weeks, then society will also benefit greater and find greater value with the ACDFP option





ACDF

VS



Disc
Arthroplasty

		ACDF	CDA
Transition Probabilities	Annual Probability of Disease Recurrence	5.8%	2.5%
	Recurrence at Index Level	65%	63%
	Recurrence at Adjacent Level	35%	37%
	Perioperative Death	0.07%	0.07%
Direct Costs (2012 USD)	Pre-operative Workup [*]	\$1,188	\$1,188
	Anesthesia Fee [†]	\$516	\$516
	Surgeon Fee	\$2,110	\$1,675
	Surgery and Acute Care [‡]	\$9,735	\$8,668
	Rehab or home health care [‡]	\$182	\$36
	Medications	\$112	\$112
	Annual Monitoring [◊]	\$251	\$251
Indirect Costs (2012 USD)	Lost productivity ^{**}	\$6,066	\$4,621

Base Case Estimated Long Term Costs for ACDF versus CDA by Patient Age

Patient Age	ACDF	CDA	Difference
45	\$31,780	\$24,119	\$7,661
50	\$30,968	\$23,437	\$7,531
55	\$29,846	\$22,610	\$7,236
60	\$28,238	\$21,588	\$6,650
65	\$26,630	\$20,621	\$6,008

Cost per QALY for lumbar fusion



- Surgery was performed initially or during the 4-year follow-up among 414/634 (65.3%) SPS, 391/601 (65.1%) DS and 789/1192 (66.2%) IDH patients. Surgery improved health, with persistent QALY differences observed through 4 years (SpS QALY gain 0.22; 95%CI: 0.15, 0.34; DS QALY gain 0.34, 95%CI: 0.30, 0.47; IDH QALY gain 0.34, 95%CI: 0.31, 0.38).
- Costs per QALY gained decreased for Spinal stenosis from \$77,600 at 2 years to \$59,400 at 4 years
- Costs per QALY gained decreased for degenerative spondylolisthesis from \$115,600 at 2 years to \$64,300 at 4 years.
- Costs per QALY gained decreased for intervertebral disc herniation from \$34,355 at 2 years to \$20,600 at 4 years.

Conclusion

- Value and Quality are different
- Value is a combination of factors
- Cost is relative to the stake holder
- More data about cost and value are necessary