

Patient Safety and Quality of Care

*Preoperative Optimization,
Intraoperative Standardization,
Postoperative Accountability*



Sigurd Berven, MD
Professor in Residence
UC San Francisco

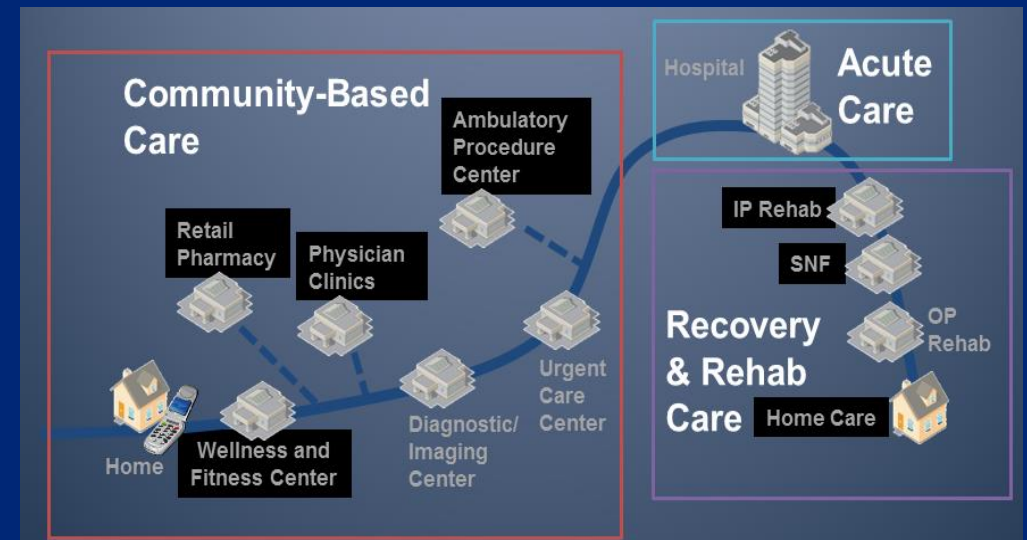


Overview

- Continuum of Care
 - Preoperative, Intraoperative and Post-operative
- Surgical Risk
 - Basis for choosing appropriateness of care and informed choice
- Risk Stratification Tools-
 - Independent predictors of Risk- Modifiable and Fixed
- Standards for Complication Rates
 - Observed vs Expected
 - Adjusting Risk- preoperative optimization and intraoperative standardization
- Predictive Modeling
 - Risk Stratification in establishing standards/Expected Rates
 - Tools for estimating and modifying risk

Focus on the Full Continuum of Care Rather than the Episode of Care

- Outpatient Wellness
 - Preventative Health
 - Pharmacologics
- Emergency Visits
- Hospital Care
 - Limit cost of acute care
- Transitional Care Facilities
 - Limit Readmissions
- Home Care



Continuum of Care for Spinal Disorders

- Non-operative Spine
 - Integration with Pain Management Service and Radiology to create an integrated non-operative spine service
- Prehabilitation
 - Pre-operative Optimization of patients for surgery
- Operative Care
 - Intraoperative pathways in consultation with anesthesia
 - Co-surgeries, Integration between Orthopaedic and Neurosurgery
- Post-operative Care Program
 - Accountability After Discharge

Risk as the Basis of Informed Choice and Appropriate Care

Empowering informed choice in the management of Spinal Disorders

- Valid Information on Natural History
- Valid Information on Outcomes of operative and non-operative options
 - Risks of Care
 - Expected Benefits of Care

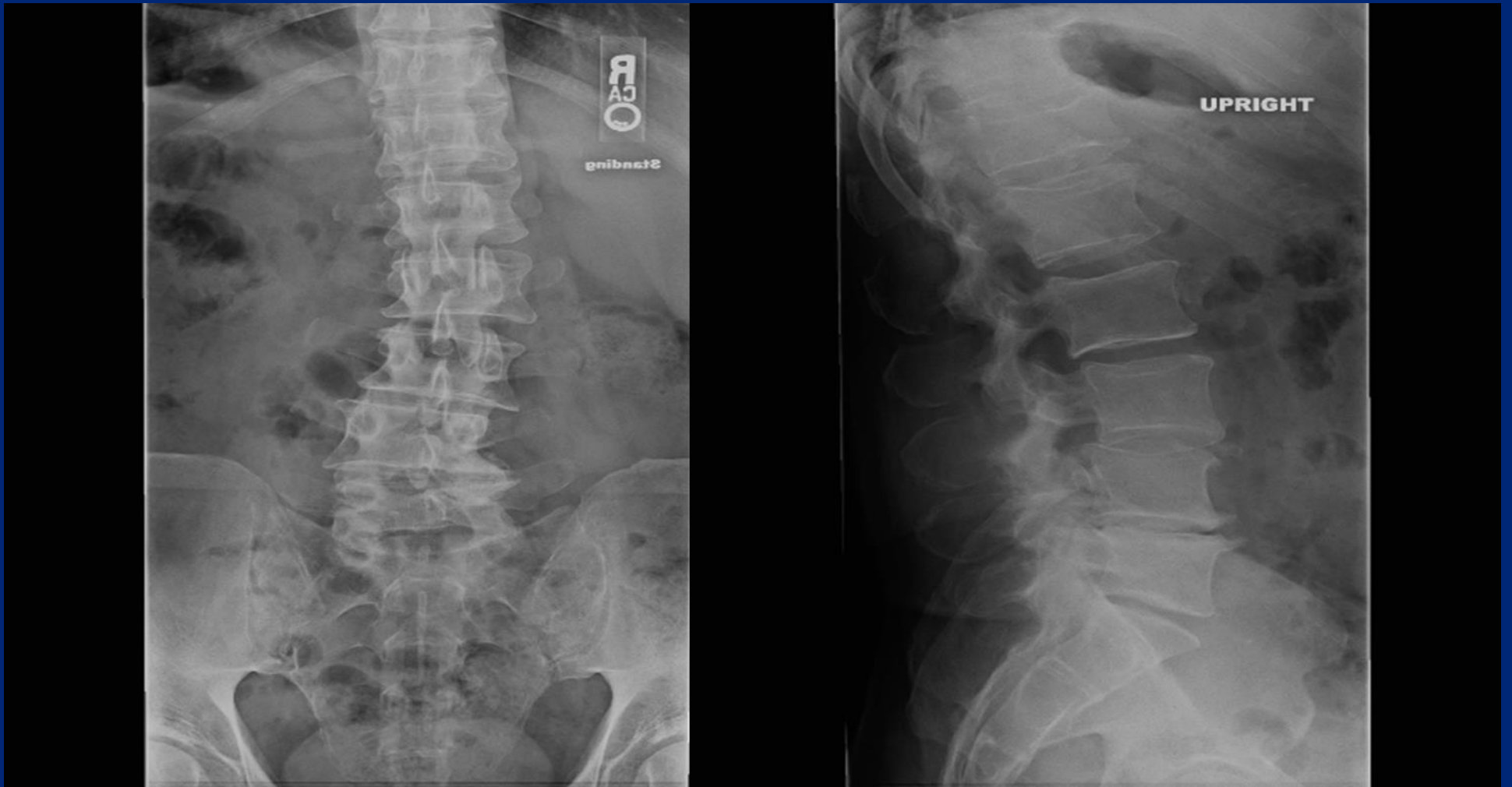


What is Risk and Why is Risk Important?

- Quality metrics
 - Accurate Estimate of Expected rates of complication
- Patient and Payor and Hospital expectations
- Resource allocation decisions
 - When to Say No /When to Say Not Yet
- Shared Risk Alternative Payment Models
 - ACO
 - 90 day bundled payments
- Informed Consent and shared decision making



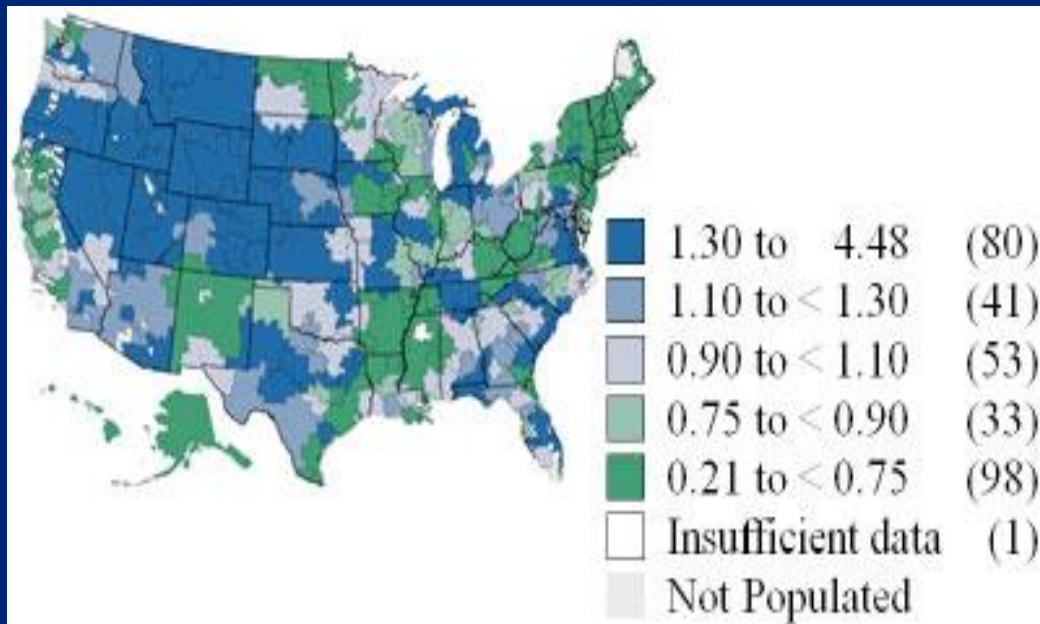
Making Decisions under Conditions of Uncertainty





Variability in approach to care

- Management of Spinal Deformity is Characterized by significant variability
 - Regional Variation/Surgical Signature
 - Patient Values and Preferences
 - Recognition of factors that predict outcome and risk

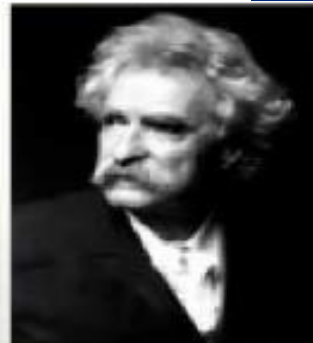


Reducing Variability

- Variability is a proxy for quality of care
 - Reducing variability is related to improved quality of care
- Clinical Practice Guidelines
- Appropriate Use Criteria
 - Areas of Consensus
 - Areas of Discordance
 - Areas for Further Study



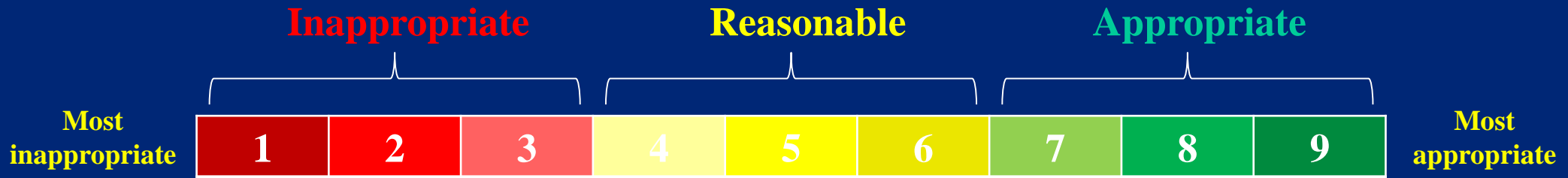
It ain't what you don't know
that gets you into trouble. It's
what you know for sure that
just ain't so.



Rand/UCLA AUC Methodology

Making Informed Choices under conditions of Uncertainty

Instructions for Rating Management Procedures and Strategies



An *inappropriate* procedure or management strategy is defined as one in which **the value (benefit per unit cost) is LOW:**

The expected negative consequences exceeds the expected health benefit such that the procedure should not be performed.

A *reasonable* procedure or management strategy is one in which:

The balance of risk and benefit are not known, but there is a reasonable chance of positive net benefit, with limited risk.

An *appropriate* procedure or management strategy is defined as one in which **the value (benefit per unit cost) is HIGH:**

The expected health benefit exceeds the expected negative consequences by a sufficiently wide margin that the procedure is worth doing.

Appropriate Use Criteria

- AUC indicate reasonable care based on available evidence combined with a rigorous, transparent recommendation process and well-defined scenarios.
- Appropriate Use Criteria (AUC) specify when it is appropriate to perform a medical procedure or service. An “appropriate” procedure is one for which the expected health benefits exceed the expected health risks by a wide margin.

Surgery for Degenerative Lumbar Scoliosis: The Development of Appropriateness Criteria

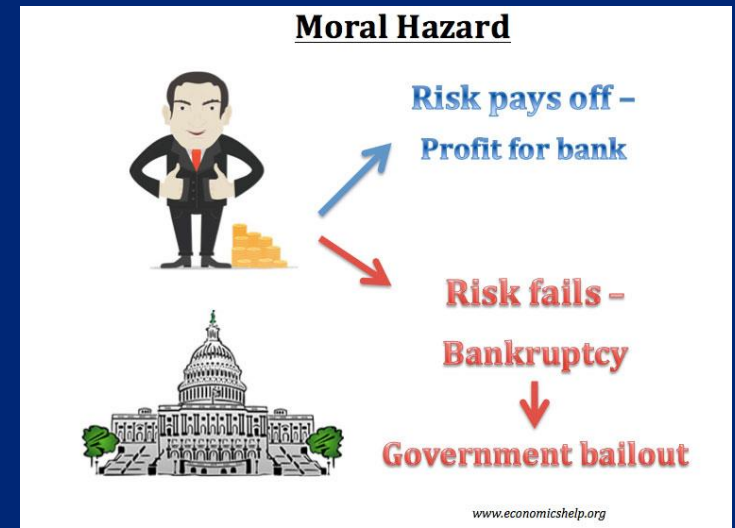
Chen, Peggy Guey-Chi MD, MSc, MHS; Daubs, Michael D. MD; Berven, Sigurd MD; Rassen, Laura B. MPH; Anderson, Ashaunta T. MD, MPH, MS; Asch, Steven M. MD, MPH; Nuckols, Teryl K. MD MSHS; and the Degenerative Lumbar Scoliosis Appropriateness Group

- Drivers of Appropriateness
 - Pre-operative Symptoms
 - Progression of Deformity
 - Sagittal Alignment
 - Comorbidities

Necessary: Benefits Outweigh Risks and Would Be Improper Not to Offer				
Moderate to severe	Any	None to mild	Curve $\geq 30^\circ$	
Moderate to severe	Severe	None to moderate		
Moderate to severe	Severe	Severe	Progression OR imbalance OR both	
Moderate to severe	Severe	Severe	Curve $< 30^\circ$	Progression AND imbalance
Moderate to severe	Moderate	None to moderate	Progression OR imbalance OR both	
Moderate to severe	Moderate	Severe	Progression, imbalance, AND curve $\geq 30^\circ$	
Moderate to severe	None to mild	None to moderate	Progression AND imbalance	

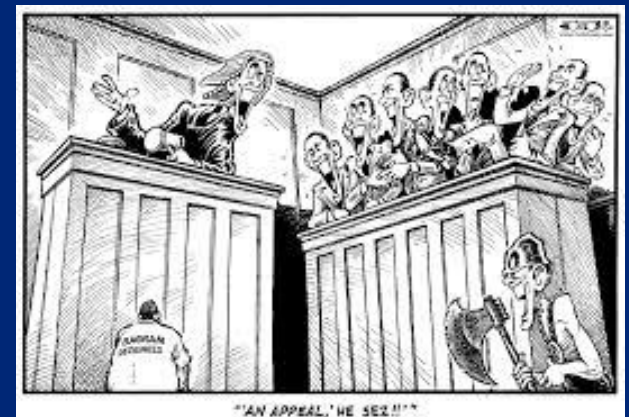
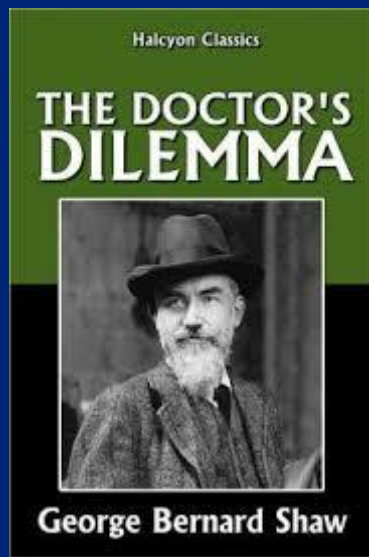
Making Decisions under Conditions of Uncertainty

- Moral Hazard
 - Dissociation of the risk and benefit
 - Party that makes decision is recipient of benefit and shielded from risk
 - Insurance, Banking, Medicine



Medical Decision Making

- Disassociation between the Decision maker and the Beneficiary
 - Judge and Executioner
 - Home Inspector and Contractor



Multidisciplinary Care: Integrated Care=Optimal/Appropriate

- Spine Surgeons
- Physiatry
- Anesthesia
 - Pain management
- Physical Therapy
- Radiology
- Neurology
- Oncology
- Primary Care
- Emergency Care
- Rheumatology
- Infectious disease

Multidisciplinary Care: Integrated Care=Optimal/Appropriate

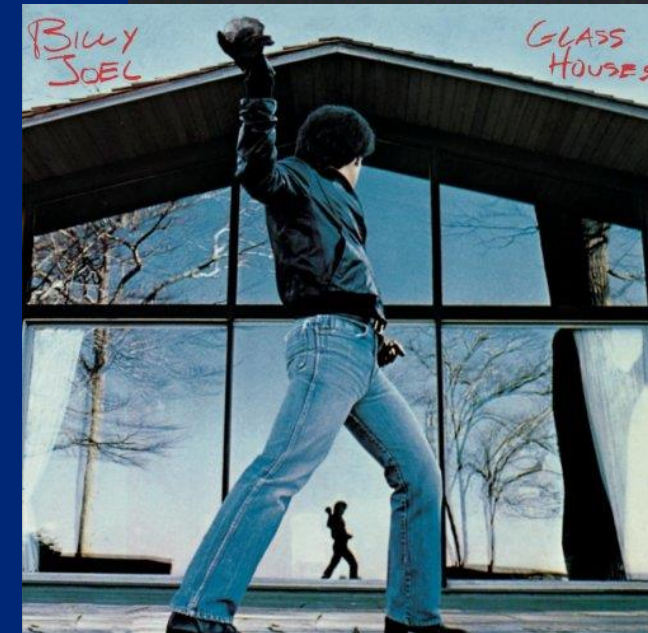
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- Rheumatology
- Infectious disease



What is an the Risk?

What is an Acceptable/Appropriate Risk?

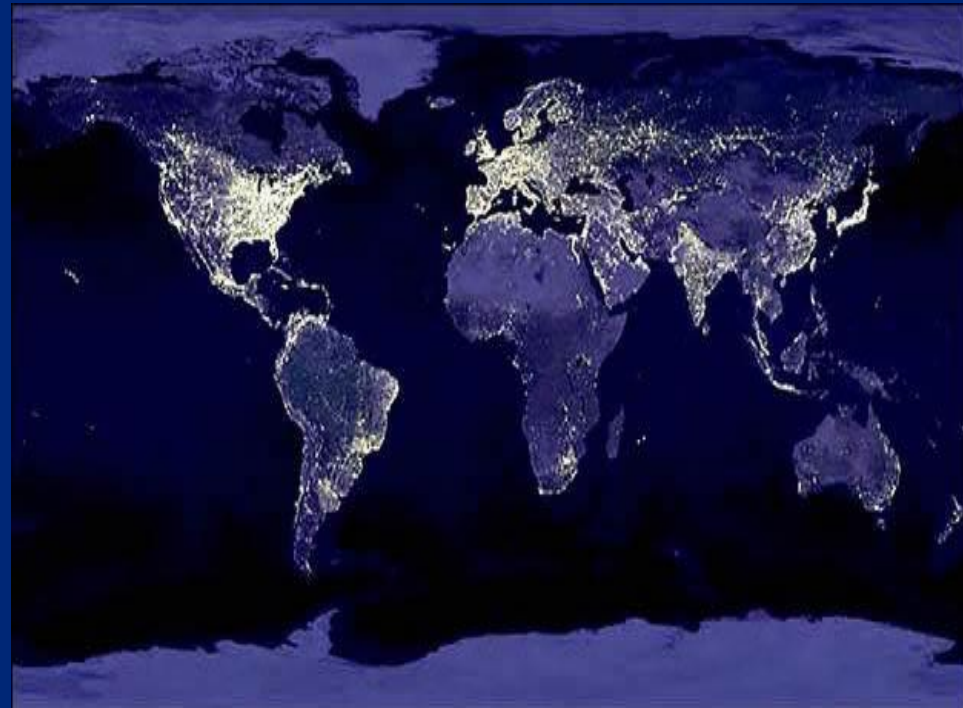
- Observed Rate of Complications
- Expected Rate of Complications
- O:E ratio provides a meaningful metric of quality of care
- Requires accurate risk stratification and global standardization/benchmarking



Detecting Perioperative Complications

Broad Spectrum of Reported Rates

- Database limitations
 - Institutional databases
 - Voluntary society databases
 - Insurance databases
- Need to return to OR for resolution
- Perioperative vs Late complications



Scoliosis Research Society Morbidity and Mortality of Adult Scoliosis Surgery

Charles A. Sansur, MD, MHSc,* Justin S. Smith, MD, PhD,† Jeff D. Coe, MD,‡ Steven D. Glassman, MD,||
Sigurd H. Berven, MD,§ David W. Polly Jr., MD,¶ Joseph H. Perra, MD,# Oheneba Boachie-Adjei, MD,**
Christopher I. Shaffrey, MD†

SPINE Volume 36, Number 9, pp E593–E597

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- 108,480 cases submitted between 2004 and 2007
 - 4980 cases of adult scoliosis (AS)
- 521 patients with complications (10.5%)
 - total of 669 complications (13.4%)
- Predictors of complications:
 - Osteotomies
 - Revision Surgery
 - Combined Anterior/Posterior Approaches
- Age and type of scoliosis were not predictors

Scoliosis Research Society Morbidity and Mortality of Adult Scoliosis Surgery

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TABLE 1. Complications in 4980 Cases of Adult Scoliosis Patients from the Years 2004–2007 Stratified by Patient Age

Complication, N (%)	Patient Age* (yrs)		
	All (n = 4980)	≤60 (n = 2920)	>60 (n = 2060)
Dural tear	142 (2.9%)	77	65
Wound infection			
Superficial	46 (0.9%)	28	37
Deep	73 (1.5%)	43	46
Implant complication	80 (1.6%)	50	30
Acute neurological	49 (1.0%)	31	18
Delayed neurological	41 (0.5%)	22	19
Epidural hematoma	12 (0.2%)	8	4
Wound hematoma	22 (0.4%)	12	10
Cardiac	7 (0.1%)	1	6
Pulmonary embolus	12 (0.2%)	7	5
Pulmonary (not PE)	31 (0.5%)	21	10
DVT	9 (0.2%)	4	5
Death	17 (0.3%)	9	8
Sepsis	6 (0.1%)	3	3
Visual acuity change	3 (0.06%)	2	1
Other complication	119 (2.4%)	65	54
Total number patients with complications	521 (10.5%)	295 (10.1%)	226 (11.0%)
Total complication†	669 (13.4%)	384 (13.2%)	321 (15.6%)

Scoli-RISK-1: Neural Change

	Total
Discharge (N = 266)	
Decline	59 (23%)
Six Weeks (N = 268)	
Decline	48 (18%)
Six Months (N = 268)	
Decline	30 (11%)



Prospective multicenter assessment of perioperative and minimum 2-year postoperative complication rates associated with adult spinal deformity surgery

J Neurosurg Spine February 26, 2016

Justin S. Smith, MD, PhD,¹ Eric Klineberg, MD,² Virginie Lafage, PhD,³ Christopher I. Shaffrey, MD,¹ Frank Schwab, MD,³ Renaud Lafage, MS,³ Richard Hostin, MD,⁴ Gregory M. Mundis Jr., MD,⁵ Thomas J. Errico, MD,³ Han Jo Kim, MD,⁵ Themistocles S. Protopsaltis, MD,³ D. Kojo Hamilton, MD,⁶ Justin K. Scheer, BS,⁷ Alex Soroceanu, MD,⁸ Michael P. Kelly, MD,⁹ Breton Line, BSME,¹⁰ Munish Gupta, MD,² Vedat Deviren, MD,¹¹ Robert Hart, MD,¹² Douglas C. Burton, MD,¹³ Shay Bess, MD,¹⁰ Christopher P. Ames, MD,¹⁴ and the International Spine Study Group

- Prospective study of 346 patients, 291 with 2 year f/u their mean age was 56.2 years.
- Overall, 203/291 patients (69.8%) had at least one complication
 - 52.2% of patients with perioperative complication
 - 42.6% of patients had a delayed complication
 - 28.2% required at least one revision

Prospective multicenter assessment of perioperative and minimum 2-year postoperative complication rates associated with adult spinal deformity surgery

J Neurosurg Spine February 26, 2016

Justin S. Smith, MD, PhD.¹ Eric Klineberg, MD.² Virginia Lafage, PhD.³

TABLE 2. Rates of complications in 291 patients surgically treated for ASD who had a minimum 2-year follow-up

Complication Category	Minor/Major Complications (%)		
	Periop (<6 wks)	Delayed (>6 wks)	Total
Implant	3/8 (3.8)	11/59 (24.1)	14/67 (27.8)
Radiographic	4/10 (4.8)	25/42 (23.0)	29/52 (27.8)
Neurological	21/24 (15.5)	16/20 (12.4)	37/44 (27.8)
Operative	41/32 (25.1)	0/1 (0.3)	41/33 (25.4)
Cardiopulmonary	31/20 (17.5)	1/3 (1.4)	32/23 (18.9)
Infection	11/20 (10.7)	5/7 (4.1)	16/27 (14.8)
Gastrointestinal	24/1 (8.6)	0/0 (0)	24/1 (8.6)
Wound (excluding infection)	3/7 (3.4)	0/5 (1.7)	3/12 (5.2)
Vascular	4/0 (1.4)	1/0 (0.3)	5/0 (1.7)
Musculoskeletal	0/0 (0)	3/0 (1.0)	3/0 (1.0)
Renal	1/2 (1.0)	0/0 (0)	1/2 (1.0)
Other	2/1 (1.0)	0/0 (0)	2/1 (1.0)
Total (minor/major)	270 (145/125)	199 (62/137)	469 (207/262)
Mean no. of complications/patient (minor/major)	0.93 (0.50/0.43)	0.68 (0.21/0.47)	1.61 (0.71/0.90)
Number of patients affected (%)	152 (52.2)	124 (42.6)	203 (69.8)

DEFORMITY

The Morbidity and Mortality of Fusions from the Thoracic Spine to the Pelvis in the Adult Population

Christopher R. Howe, MD, Julie Agel, MA,* Michael J. Lee, MD,† Richard J. Bransford, MD,* Theodore A. Wagner, MD,† Carlo Bellabarba, MD,* and Jens R. Chapman, MD*

TABLE 1. Return to the Operation Theatre

Infection	18 (17%)
Adjacent segment disease	12 (12%)
Nonunion	4 (4%)
Lumbosacral hardware failure	3 (3%)
Epidural hematoma	2 (2%)
Hardware removal	1 (1%)
Retained drain removal	1 (1%)
Removal of symptomatic hardware	1 (1%)
Displaced interbody allograft	1 (1%)
Total	43 (35%)

TABLE 2. Medical Complications in the 103 Patients

Major Complication	Number
Myocardial infarction	4 (4%)
Pulmonary embolism	4 (4%)
Adult respiratory distress syndrome	4 (4%)
Pneumonia	4 (4%)
Acute renal failure	3 (3%)
Cerebrovascular accident	3 (3%)
Blindness	1 (1%)
Total	23 (12%)

2011 Outstanding Paper: Surgical Science

Morbidity and mortality of major adult spinal surgery. A prospective cohort analysis of 942 consecutive patients

John T. Street, MD, PhD^{a,*}, Brian J. Lenehan, MD^a, Christian P. DiPaola, MD^a, Michael D. Boyd, MD^a, Brian K. Kwon, MD, PhD^a, Scott J. Paquette, MD^a, Marcel F.S. Dvorak, MD^a, Y. Raja Rampersaud, MD^b, Charles G. Fisher, MD^a

- 23% combined medical and surgical morbidity rate using retrospective study
- Rigorous prospective study identified 87% of patients with at least one complication
 - 10.5% intraoperative
 - 73.5% postoperative
 - Complexity of surgery is underestimated without rigorous prospective study

Predictors of Complications

- Patient Factors
 - Age
 - Co-morbidities
 - Pre-operative Health Status
 - Prior surgery
- Surgical Factors
 - Combined Anterior and Posterior Approaches
 - Staged Surgeries
 - Osteotomies
 - Large correction of sagittal plane deformity



Pre-operative Considerations

Risk Assessment

- Assess risk/benefit
 - Appropriateness of surgery
- Align expectations
- Shared decision making

Medical Optimization

- Smoking
- Nutrition
- Obesity
- Diabetes
- Cardiopulmonary
- Bone Health
- Narcotics

Surgical Planning

- Multidisciplinary Planning
 - Preoperative Planning Conference
- Manage adjacent levels
- Osteoporosis
- Guidance system

Physical Optimization

- General physical conditioning
- BMI
- Physical Therapy
- Independence
- Home Support



EMR based Risk Stratification

The screenshot shows the Epic EMR interface. The top navigation bar includes 'Hyperspace - ORTHO SPINE PARN - UCSF Production - SIGURD H BERVEN'. Below this is a toolbar with icons for 'Chart', 'Patient Station', 'Today's Pts', 'My Cases (Today)', 'All Areas', 'OR Schedules', 'Encounter', 'Remind Me', and 'Process'. A search bar is visible on the left. The main area is a 'Note Editor' with a rich text toolbar. The text in the note editor lists various clinical indicators and their associated data points:

- Blood Sugar = .labHgA1c
- Bone Health = .DEXA,.serumCA, .VitaminD)
- BMI= .BMI
- Nutrition= .serum albumin
- Infection risk= .labesr,{Microbiology Results:304002301}
- Smoking = .smoking
- Pain medications= .meds
- Coagulation status= .INR/Prothrombin Time, .NSAIDs
- Systemic Disease = .Creatinine, .liver function tests,.echocardiogram,
- Social Support = .RAPT|

- Frailty- Edmonton Frailty Score
- Mental Health- Anxiety/Depression

Surgical Planning

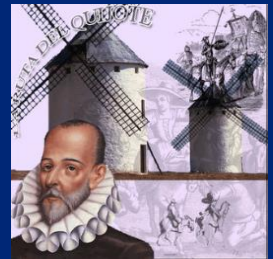
- By failing to prepare, you are preparing to fail.

- Benjamin Franklin



- Forewarned, forearmed; to be prepared is half the victory.

- Miguel de Cervantes Saavedra



- Those who plan do better than those who do not plan even though they rarely stick to their plan.

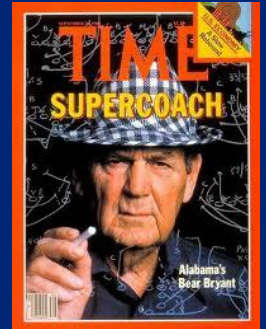
- Winston Churchill



Surgical Planning

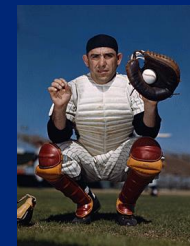
- Have a plan. Follow the plan, and you'll be surprised how successful you can be. Most people don't have a plan. That's why it's is easy to beat most folks.

- Paul "Bear" Bryant



- You got to be careful if you don't know where you're going, because you might not get there.

- Yogi Berra



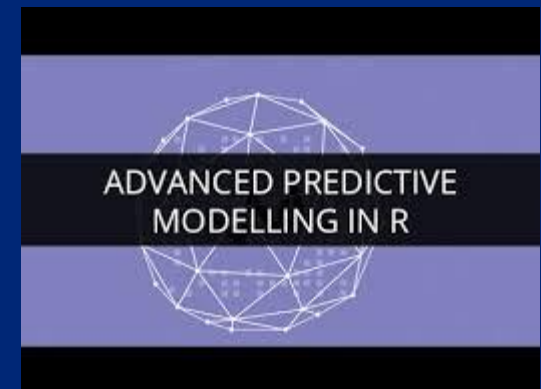
- Everyone has a plan until I hit them in the head.

• Mike Tyson



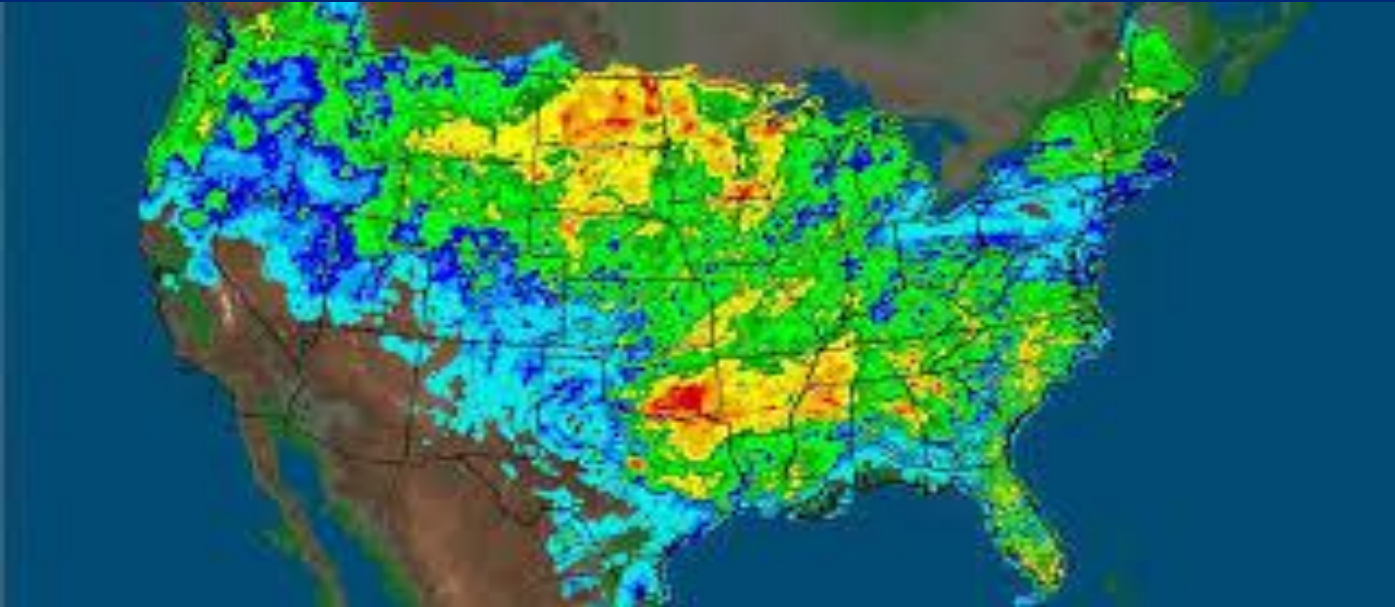
Risk Stratification Tools

- Personal Experience
- Peer Review/ Case Conferences
- Expert Opinion
 - Delphi Panels
- Modelling based upon identification of Predictor variables

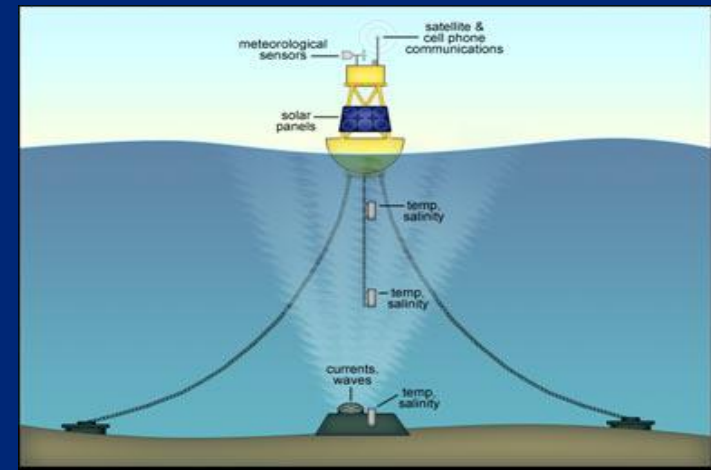


		Discharge	No. of	No. of	Case-Mix	Average Length of Stay				Vizient	Based on	Based on
Attending MD	Fiscal Ye	Discharg	Patient Da	Index	Observ	Geometric Me	Case Mix Adjust	Vizient Expect	LOS Ind	Geometric Me	Vizient Expect	
	2018	6	21	1.61	3.50	2.93	2.18	2.85	1.23	3	4	
	2018	28	51	2.36	1.82	2.96	0.77	2.54	0.72	(32)	(20)	
	2019	20	50	2.44	2.50	2.73	1.02	2.51	1.00	(5)	(0)	
	2019	11	34	2.42	3.09	2.98	1.28	4.13	0.75	1	(11)	
Berven, Sigurd	2018	175	916	4.71	5.23	4.12	1.11	4.87	1.07	195	63	
Berven, Sigurd	2019	69	340	4.48	4.93	3.78	1.10	4.49	1.10	79	30	
	2018	192	430	2.39	2.24	2.99	0.94	2.76	0.81	(143)	(99)	
	2019	74	196	2.17	2.65	2.62	1.22	2.93	0.90	2	(21)	
	2018	133	747	5.29	5.62	4.22	1.06	4.82	1.16	186	106	
	2019	55	322	4.98	5.85	3.85	1.18	4.78	1.23	110	59	
	2018	104	644	5.80	6.19	4.55	1.07	5.65	1.10	171	57	
	2019	44	210	4.80	4.77	3.84	0.99	5.43	0.88	41	(29)	
	2018	129	396	3.10	3.07	3.80	0.99	3.32	0.92	(94)	(33)	
	2019	40	152	3.53	3.80	4.05	1.08	3.70	1.03	(10)	4	
	2018	39	79	2.41	2.03	2.28	0.84	2.65	0.76	(10)	(24)	
	2019	11	23	2.03	2.09	3.26	1.03	3.38	0.62	(13)	(14)	
	2018	353	918	2.38	2.60	3.07	1.09	2.92	0.89	(166)	(112)	
	2019	120	297	2.30	2.48	2.89	1.08	2.95	0.84	(49)	(57)	
	2018	38	157	1.78	4.13	4.02	2.32	5.73	0.72	4	(61)	
	2019	10	44	1.70	4.40	3.80	2.59	4.36	1.01	6	0	
	2018	115	502	2.13	4.37	3.90	2.05	3.78	1.15	53	67	
	2019	33	136	2.31	4.12	4.44	1.78	4.36	0.94	(10)	(8)	
	2018	119	169	2.32	1.42	1.91	0.61	2.10	0.68	(58)	(81)	
	2019	52	76	2.35	1.46	1.78	0.62	1.93	0.76	(17)	(24)	
	2018	11	35	2.06	3.18	3.30	1.55	3.60	0.88	(1)	(5)	
	2019	9	44	2.28	4.89	3.62	2.14	3.67	1.33	11	11	
	2018	67	343	4.40	5.12	3.99	1.16	4.43	1.15	76	46	
	2019	45	240	3.50	5.33	3.54	1.53	4.52	1.18	81	37	

Predictive Modelling



IR7_



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YOUR SPINE TREATMENT CALCULATOR

This calculator shows possible patient results for physical activity, pain and overall health after surgical or [non-surgical](#) treatment for low back related pain. The data used come from the Spine Patient Outcomes Research Trial (SPORT)[®]. This tool is for people whose doctor has told them that they have one of the diagnoses listed below.

Choose one of the diagnoses below.

Sciatica/Ruptured Disc (Herniated Disc): A vertebral disc is a soft gel-like structure with a normally strong covering that sits between each vertebra in your back and acts like a cushion. A herniated disc happens when this disc has broken down and part of it is pressing on a nerve. The pressure causes pain that most often runs from your back through your buttocks and down one leg.

Pinched Nerve (Spinal Stenosis): This is usually from arthritis in the back. The pain is generally in the lower back and it may also shoot down your leg from your buttocks when walking, but not sitting.

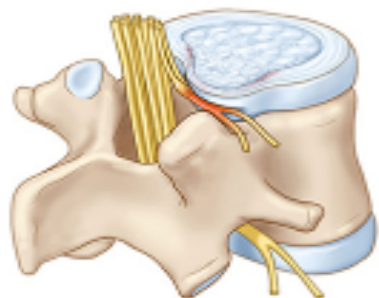
Slipped Vertebra (Degenerative Spondylolisthesis or DS): DS is a condition in which one or more vertebrae move out of place, usually forward, and cause pain similar to that felt with spinal stenosis (see above).

This calculator does not apply to other diagnoses or to a combination of diagnoses.

Select your diagnosis:

- Sciatica/Ruptured Disc (Herniated Disc)
- Pinched Nerve (Spinal Stenosis)
- Slipped Vertebra (Degenerative Spondylolisthesis or DS)

[Proceed to Calculator](#)



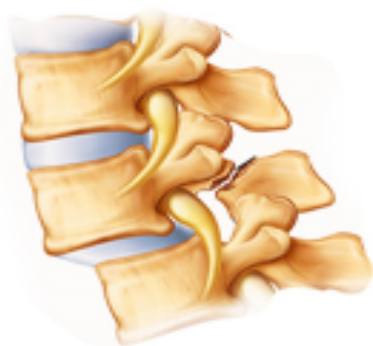
Sciatica/Slipped Disc (Herniated Disc)

A spinal disc is a soft gel-like structure with a strong covering that sits between each vertebra in your back and acts like a cushion. Sometimes the covering gets weak and the gel can poke out against a nerve. This causes pain that most often runs from your back through your buttocks and down your leg.



Spinal Stenosis

This is from arthritis in the back that narrows the spaces around the nerves. Along with pain in the lower back there is also pain in one or both legs when walking. The pain usually improves with sitting down or bending forward.

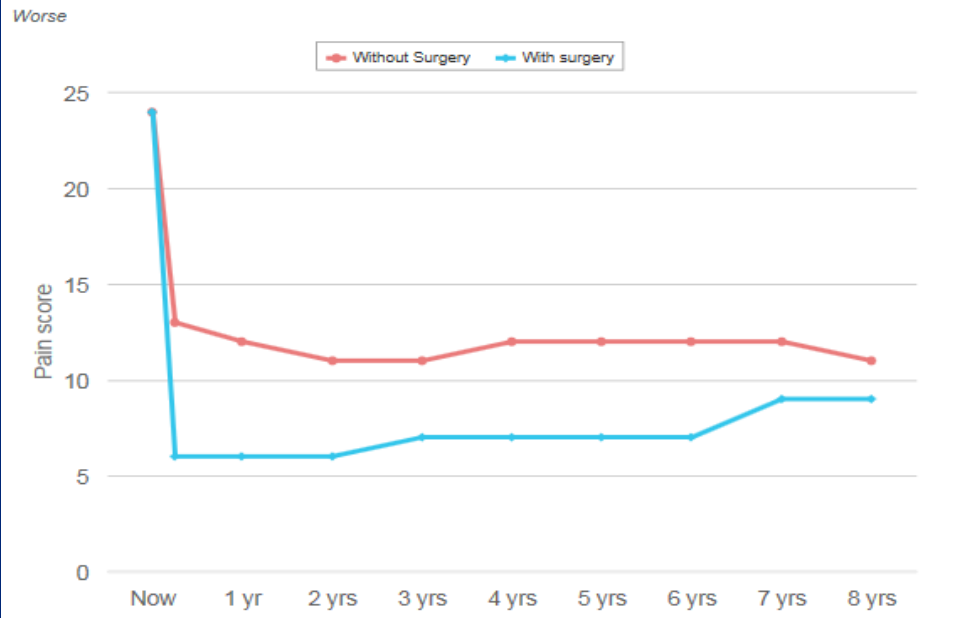


Slipped Vertebra (Degenerative Spondylolisthesis)

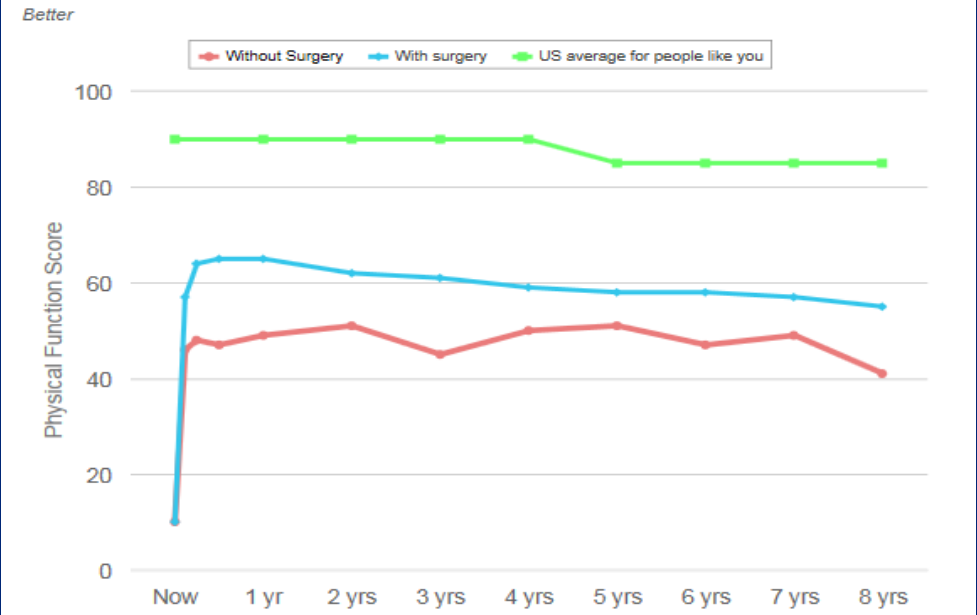
This is a condition in which one or more vertebrae move out of place, usually forward, and cause pain similar to that felt with spinal stenosis (see above).

- Dartmouth Spine Calculator

Your pain score over time



Your ability to be physically active over time



SpineSage is a predictive modeling tool based on data from the Spine End Results Registry: 1476 patients

The Spine End Results Registry

Prospectively collected data registry for all patients undergoing spine surgery at Harborview Medical Center and University of Washington Medical Center from January 1st 2003, to December 31st, 2004.

- Extensive co-morbidity and demographic data were defined a priori and collected prospectively for each surgical patient.**
- Complications were defined a priori and were prospectively recorded for at least 2 years following the surgery.**

Several multivariate log-binomial analyses were performed to identify and quantify risk factors for these complications after spine surgery and have been published in the peer-refereed literature.

Predicting medical complications after spine surgery: a validated model using a prospective surgical registry

Spine J. 2014 February 1; 14(2): 291–299.

Michael J. Lee, MD*, Amy M. Cizik, MPH, Deven Hamilton, PhD, and Jens R. Chapman, MD

Department of Orthopaedic Surgery and Sports Medicine, University of Washington Medical Center, Seattle, WA 98195, USA

- Predictive Model for Medical Complication after spine surgery
- Input Variables:
 - Age, gender, smoking status, alcohol use, diabetes, body mass index, insurance status, surgical approach, revision surgery, surgery region, diagnosis, surgical invasiveness
 - Hypertension, CHF, COPD
 - Rheumatoid arthritis, renal disease, liver disease, cancer, anemia, bleeding disorder

$$\text{Predicted Probability of Adverse Event} = B_{1(\text{Gender})} + B_{2(\text{COPD})} + B_{3(\text{HYTN})} + B_{4(\text{PrevCardiac})} + B_{5(\text{Age})} + B_{6(\text{SII})} + B_{7(\text{Trauma})} + B_{8(\text{OtherDx})} + B_{0(\text{Intercept})}$$

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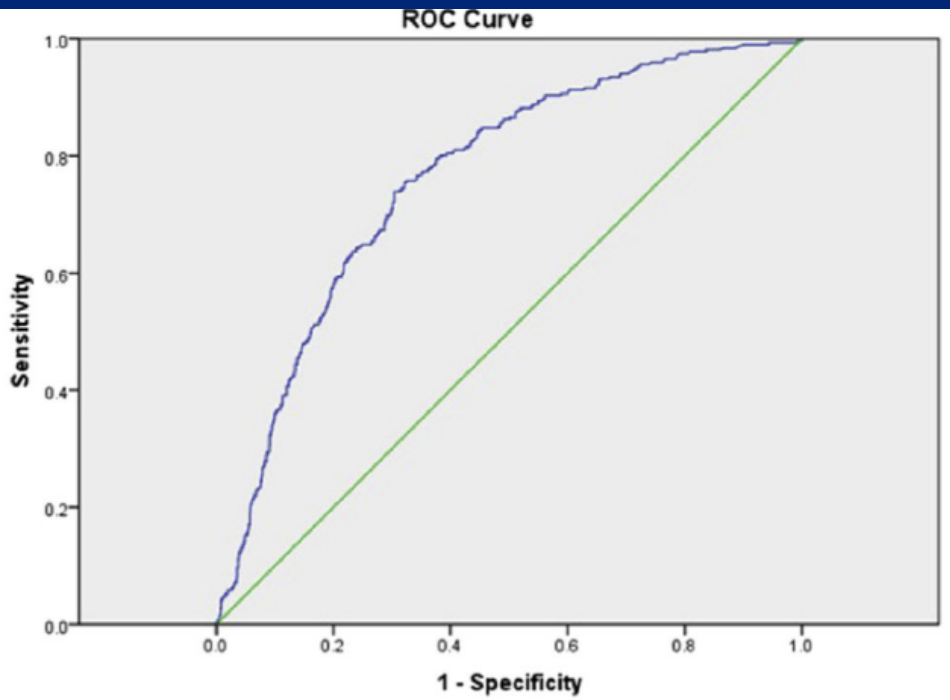


Fig. 2.

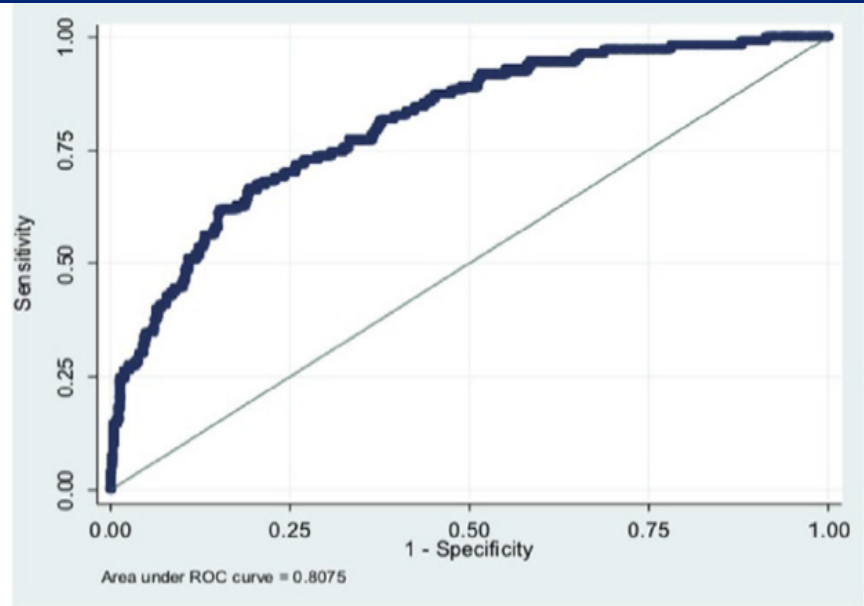


Fig. 3.

Receiver operator curve for any medical complication. Area under the curve is 0.76. Receiver operator curve for major medical complication. Area under the curve is 0.81.

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[Spine Sage Complication Calculator](#)

A Novel Approach to Global Benchmarking of Risk-Adjusted Surgical Outcomes Beyond Perioperative Mortality Rate

JAMA Surgery
Published online
April 6, 2016

- Commission on Global Surgery recommendation on improving quality in surgery by reporting O:E rates
- The risk calculator was built using data collected from > 2.7 million operations from 586 hospitals participating in ACS NSQIP from 2010-14.

A Novel Approach to Global Benchmarking of Risk-Adjusted Surgical Outcomes Beyond Perioperative Mortality Rate

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Box. A Minimal Data Set for Global Benchmarking in Surgery^a

Patient Demographic Characteristics

Age

Sex

Height

Weight

Procedure-Related Variables

Name of procedure (converted to *Current Procedural Terminology* code by the risk calculator)

Emergency case (yes or no)

American Society of Anesthesiologists classification (class I-V)

Wound class (clean, clean-contaminated, contaminated, or dirty-infected)

Preoperative Risk Assessment

Steroid use for chronic condition (yes or no)

Ascites within 30 days prior to surgery (yes or no)

Systemic sepsis within 48 hours prior to surgery (none, systemic inflammatory response syndrome, sepsis, or septic shock)

Ventilator dependent (yes or no)

Disseminated cancer (yes or no)

Diabetes (none, oral medication, or insulin medication)

Hypertension requiring medication (yes or no)

Previous cardiac event (yes or no)

Congestive heart failure in 30 days prior to surgery (yes or no)

Dyspnea (none, with moderate exertion, or at rest)

Current smoker within 1 year (yes or no)

History of severe chronic obstructive pulmonary disease (yes or no)

Dialysis (yes or no)

Acute renal failure (yes or no)

Outcome Measures

Pneumonia (yes or no)

Cardiac complication (yes or no)

Surgical site infection (yes or no)

Urinary tract infection (yes or no)

Venous thromboembolism (yes or no)

Renal failure (yes or no)

Unplanned return to the operating theater (yes or no)

Death (yes or no)

^a Adapted from the American College of Surgeons National Surgical Quality Improvement Program Surgical Risk Calculator.⁴

A Novel Approach to Global Benchmarking of Risk-Adjusted Surgical Outcomes Beyond Perioperative Mortality Rate

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- [NSQIP Calculator](#)

i Procedure

22207 - Osteotomy of spine, posterior or posterolateral approach, 3 columns, 1 vertebral segment (eg, pedicle/vertebral body subtraction); lumbar

Clear

Begin by entering the procedure name or CPT code. One or more procedures will appear below the procedure box. You will need to click on the desired procedure to properly select it. You may also search using two words (or two partial words) by placing a '+' in between, for example: "cholecystectomy + cholangiography"

Reset All Selections

i Are there other potential appropriate treatment options? Other Surgical Options Other Non-operative options None

*Please enter as much of the following information as you can to receive the best risk estimates.
A rough estimate will still be generated if you cannot provide all of the information below.*

Age Group

Under 65 years ▾

Sex

Female ▾

Functional Status **i**

Independent ▾

Emergency Case **i**

No ▾

ASA Class **i**

Healthy patient ▾

Steroid use for chronic condition **i**

No ▾

Ascites within 30 days prior to surgery **i**

No ▾

Systemic Sepsis within 48 hours prior to surgery **i**

None ▾

Ventilator Dependent **i**

No ▾

Disseminated Cancer **i**

No ▾

Diabetes **i**

No ▾

Hypertension requiring medication **i**

No ▾

Congestive Heart Failure in 30 days prior to surgery **i**

No ▾

Dyspnea **i**

No ▾

Current Smoker within 1 Year **i**

No ▾

History of Severe COPD **i**

No ▾

Dialysis **i**

No ▾

Acute Renal Failure **i**

No ▾

BMI Calculation: **i**

Height: in / cm

Weight: lb / kg

Procedure: 22207 - Osteotomy of spine, posterior or posterolateral approach, 3 columns, 1 vertebral segment (eg, pedicle/vertebral body subtraction); lumbar

Change Patient Risk Factors

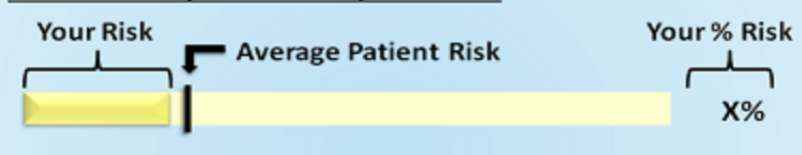
Risk Factors:

Outcomes ⓘ

		Your Risk	Average Risk	Chance of Outcome
Serious Complication		8.0%	18.3%	Below Average
Any Complication		9.0%	19.9%	Below Average
Pneumonia		0.3%	2.0%	Below Average
Cardiac Complication		0.0%	0.4%	Below Average
Surgical Site Infection		1.4%	2.7%	Below Average
Urinary Tract Infection		1.3%	2.6%	Below Average
Venous Thromboembolism		1.2%	3.2%	Below Average
Renal Failure		0.0%	0.2%	Below Average
Readmission		3.5%	7.7%	Below Average
Return to OR		3.1%	5.6%	Below Average
Death		0.0%	0.3%	Below Average
Discharge to Nursing or Rehab Facility		10.0%	30.1%	Below Average

Predicted Length of Hospital Stay: 4.5 days

How to Interpret the Graph Above:



Surgeon Adjustment of Risks ⓘ

This will need to be used infrequently, but surgeons may adjust the estimated risks if they feel the calculated risks are underestimated. This should only be done if the reason for the increased risks was NOT already entered into the risk calculator.

1 - No adjustment necessary ⌵

Please enter as much of the following information as you can to receive the best risk estimates.
A rough estimate will still be generated if you cannot provide all of the information below.

Age Group

75-84 years

Sex

Female

Functional Status 

Partially Dependent

Emergency Case 

No

ASA Class 

Severe systemic disease

Steroid use for chronic condition 

No

Ascites within 30 days prior to surgery 

No

Systemic Sepsis within 48 hours prior to surgery 

None

Ventilator Dependent 

No

Disseminated Cancer 

No

Diabetes 

Oral

Hypertension requiring medication 

Yes

Congestive Heart Failure in 30 days prior to surgery 

No

Dyspnea 

No

Current Smoker within 1 Year 

No

History of Severe COPD 

No

Dialysis 

No

Acute Renal Failure 

No

BMI Calculation: 

Height (in)

Weight (lbs)

[Risk Calculator Home Page](#)

[About](#)

[FAQ](#)

[ACS Website](#)

[ACS NSQIP Website](#)

Procedure: 22207 - Osteotomy of spine, posterior or posterolateral approach, 3 columns, 1 vertebral segment (eg, pedicle/vertebral body subtraction); lumbar

Risk Factors: 75-84 years, Partially dependent functional status, ASA Severe systemic disease, Diabetes (Oral), HTN, Over Weight

[Change Patient Risk Factors](#)

Outcomes ⓘ

		Your Risk	Average Risk	Chance of Outcome
Serious Complication		28.0%	18.3%	Above Average
Any Complication		29.5%	19.9%	Above Average
Pneumonia		3.9%	2.0%	Above Average
Cardiac Complication		1.3%	0.4%	Above Average
Surgical Site Infection		2.9%	2.7%	Average
Urinary Tract Infection		8.0%	2.6%	Above Average
Venous Thromboembolism		4.6%	3.2%	Above Average
Renal Failure		0.3%	0.2%	Above Average
Readmission		11.8%	7.7%	Above Average
Return to OR		6.8%	5.6%	Above Average
Death		1.2%	0.3%	Above Average
Discharge to Nursing or Rehab Facility		84.1%	30.1%	Above Average

Intra-operative Considerations

Blood Conservation/Fluid Management

- Amicar/TXA
- Cellsaver
- Transfusion Protocol
- Colloid to Crystalloid ratio

Neuromonitoring

- Neuromonitoring protocols
- Algorithm for positive change

Surgical Technique

- Two attendings
- Protocol for staging
- Equipment
- Radiography
- Achieve goals of surgery
 - Intra-op
 - Post-op

Reduce complications

- Pain management
- Antibiotic prophylaxis
- Blood sugar control
- Normothermia



Six Sigma Methodology

DMAIC – Process Improvement

- Define the problem
- Measure the causes
- Analyze the root causes
- Improve with trial interventions
- Control the implementation and follow-up processes



Post-operative Considerations

Pain Management

- Standardized protocol
- Chronic Pain Considerations

Mobilization

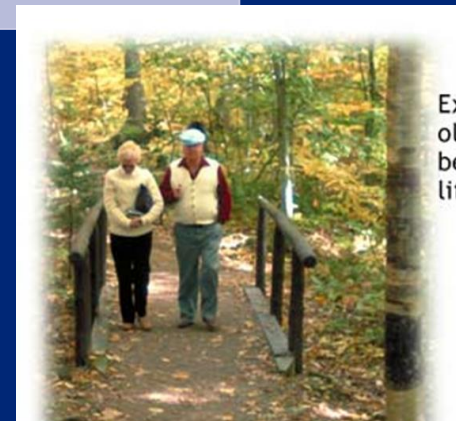
- Early Mobilization
- Post-op chairs
- PT protocols

Nutrition

- Early enteric feeding
- 2400kcal/d

Medical Complications

- DVT prophylaxis
- Delirium prevention
- Foley



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Discharge Considerations

Home

- Preoperative Preparation
- Home Health Services
- PT/OT

Rehabilitation

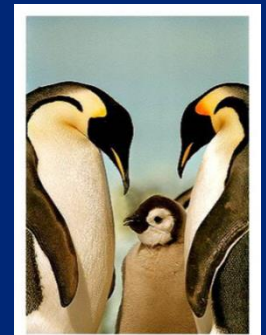
- Mobilization protocols
- Communication of Care Plan
- Precautions

SNF

- Mobilization
- PT Protocols

Communication Pathways

- Health Loop
- Nurse Navigator
- Clinic Visits over ER visits
- Measuring outcomes and PROs



Conclusions

- Spine surgery involves complex systems and interactions
- System reform across the continuum of care includes:
 - Preoperative optimization
 - Intraoperative standardization
 - Post-operative Accountability
- Patient Safety, outcomes, and value of surgery can be optimized with the adoption of system reform



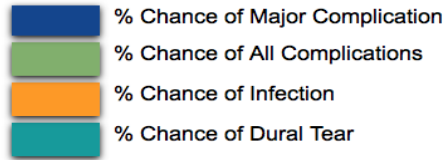
UCSF Center for Outcomes Research

Conclusions

- Risk stratification is important in empowering informed choice regarding surgery, and in determining the appropriateness of surgical management in spinal deformity
- Risk assessment is based upon variables that are difficult to measure including patient-based and surgery-based factors
- It is important to establish reasonable and accurate standards for complications with risk stratification as we move toward an era of accountability for care

Patient Age	65
Patient Gender	Female
Does the patient have Cerebrovascular Disease?	No
Does the patient have Chronic Obstructive Pulmonary Disease?	No
Does the patient have Asthma?	No
Does the patient have Hypertension?	Yes
Does the patient have Rheumatoid Arthritis?	No
Does the patient have Renal Conditions?	No
Does the patient have pre-existing Neoplasm?	No
Does the patient have a history of Syncope or Seizure?	No
Does the patient have Anemia?	No
Does the patient have a bleeding disorder?	No
Does the patient have diabetes?	Yes
Does the patient have congestive heart failure?	No
Is this a revision surgery?	No
Has the patient had a previous spinal surgery?	No
Has the patient had previous cardiac complications?	No
What is the patients BMI?	Greater than 30
Primary Diagnosis	Degenerative
Level of Surgery	Lumbosacral
Surgical Approach	Combined

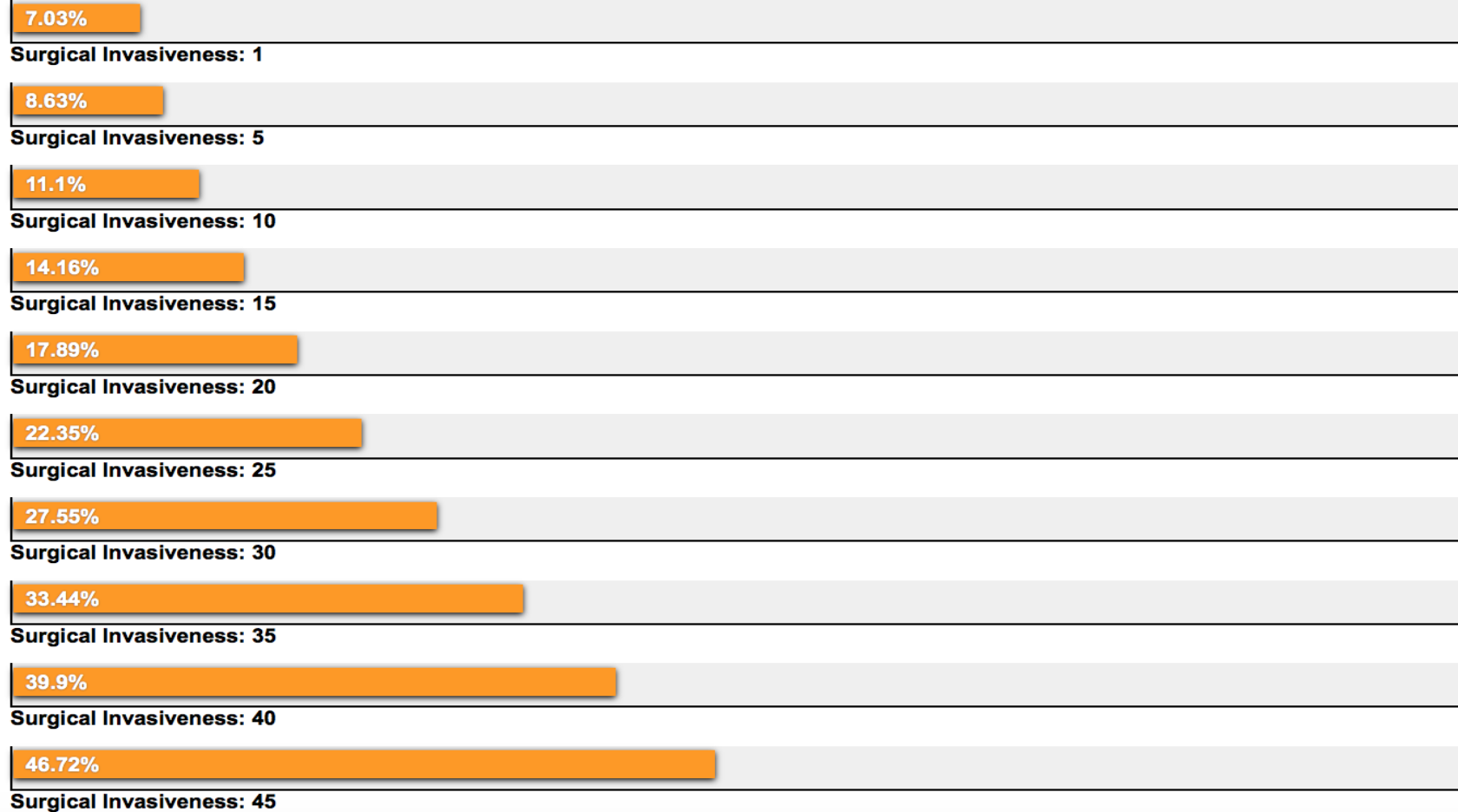
Graph Key







Surgical Invasiveness Examples

What's This?

Level	Procedure
1	L45 microdiscectomy; C56 foraminotomy
3	L2-5 laminectomy
5	L45 laminectomy, posterior lateral instrumented fusion; C56 anterior cervical discectomy and fusion
8	L45 TLIF with cage, posterior lateral instrumented fusion
14	L2-S1 laminectomy; L2-S1 instrumented posterior lateral fusion (NO interbody); C3-7 laminectomy with C3-7 posterior instrumented fusion
20	T10- S1 Posterior lateral instrumented fusion, L5-S1 interbody fusion
26	T10- S1 Posterior lateral instrumented fusion, L2-S1 interbody fusion



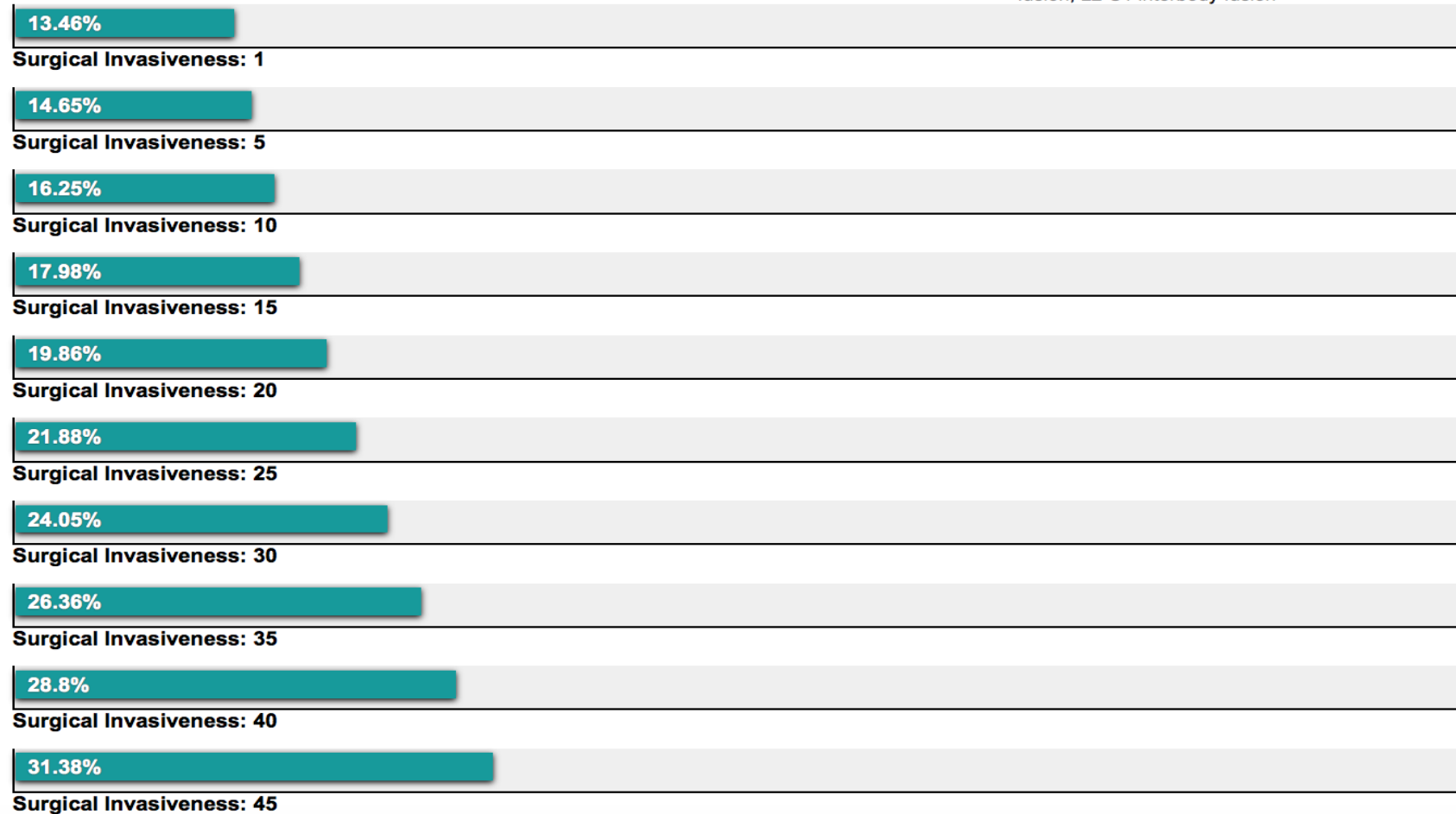
Graph Key

-  % Chance of Major Complication
-  % Chance of All Complications
-  % Chance of Infection
-  % Chance of Dural Tear

Surgical Invasiveness Examples

What's This?

Level	Procedure
1	L45 microdiscectomy; C56 foraminotomy
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20	T10- S1 Posterior lateral instrumented fusion, L5-S1 interbody fusion
26	T10- S1 Posterior lateral instrumented fusion, L2-S1 interbody fusion



Limiting Perioperative Risk

- Preoperative Planning
 - Multidisciplinary conferences
 - Patient Goals/ Surgical Goals
- Preoperative Optimization of Modifiable Risk Factors
 - Smoking
 - Bone Density/Strength
 - Cardiac/Pulmonary Disease
 - BMI
 - Social Support