Innovation and Transition to a Digital Era in Anesthesiology

David L. Reich, M.D.
Professor and Chair of Anesthesiology
Mount Sinai School of Medicine
New York, NY

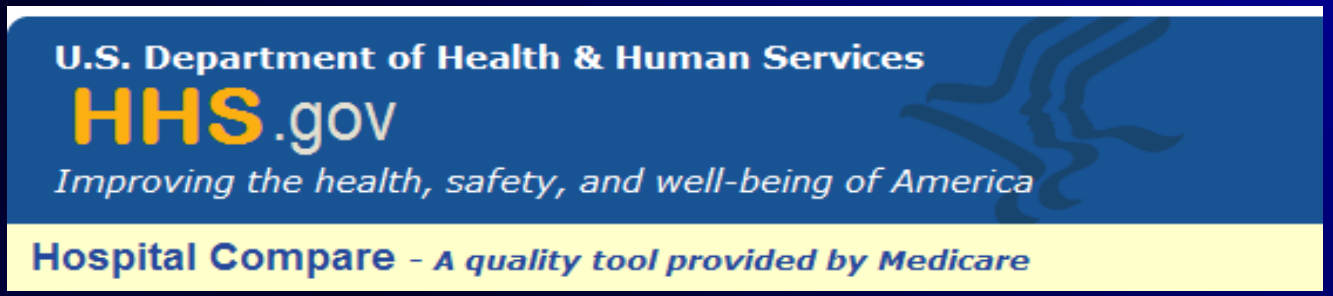
Disclosures

- Past support from Casmed
- Research support from Covidien

"Publicity is justly commended as a remedy for social and industrial diseases. Sunlight is said to be the best of disinfectants; electric light the most efficient policeman."

Louis Brandeis: Other People's Money, and How the Bankers Use It (1914)

National Imperatives

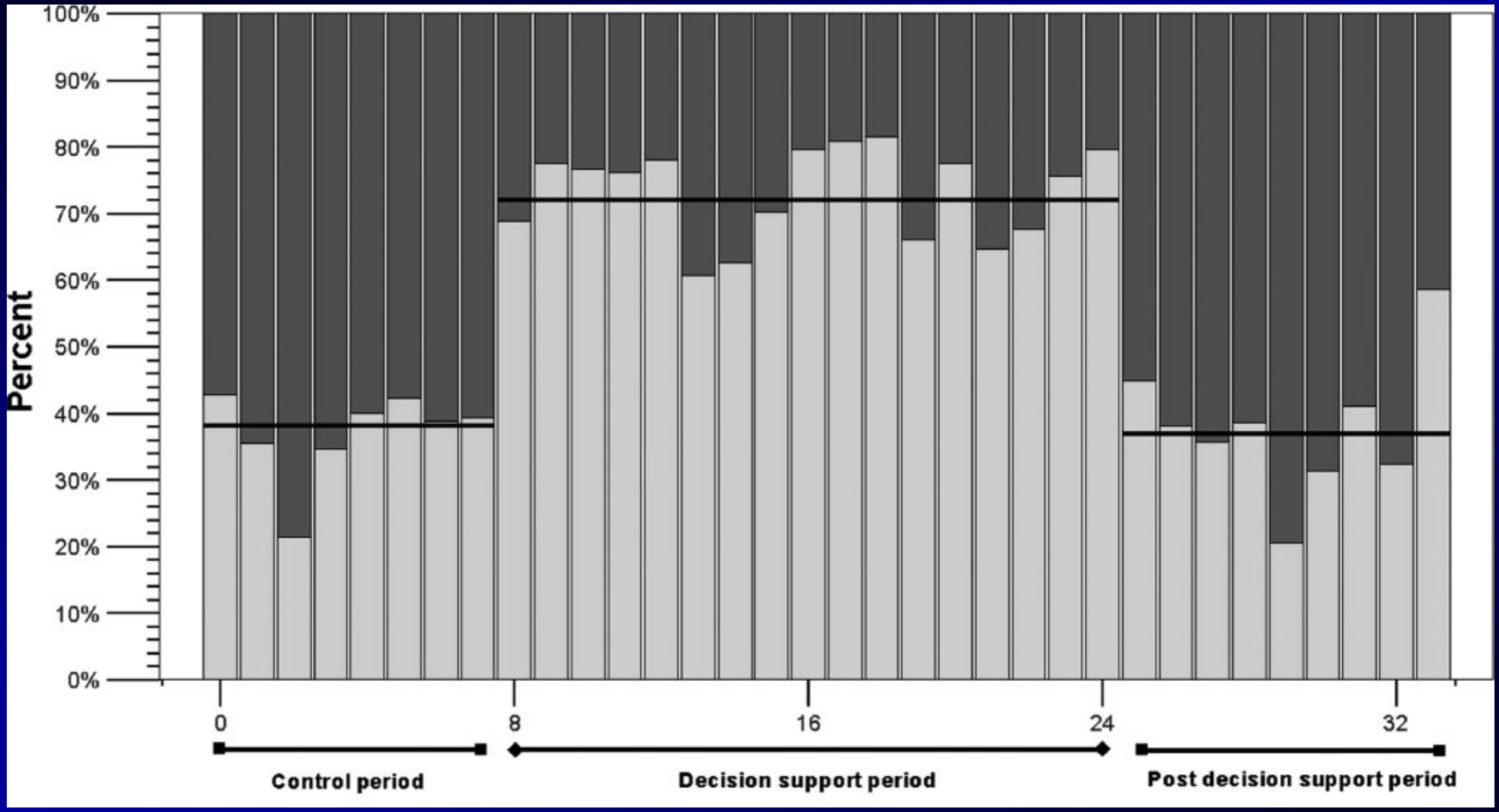


Value Based Purchasing

- 1% withhold of Medicare hospital payments
- Return of portion or all of withhold, depending upon quality metrics
  - Outcome measures
  - SCIP
  - HCAHPS, including pain management

Preoperative Assessment

PONV Decision Support



Kooij FO et al: Anesth Analg 2008;106:893-8

Intraoperative Quality Indicators

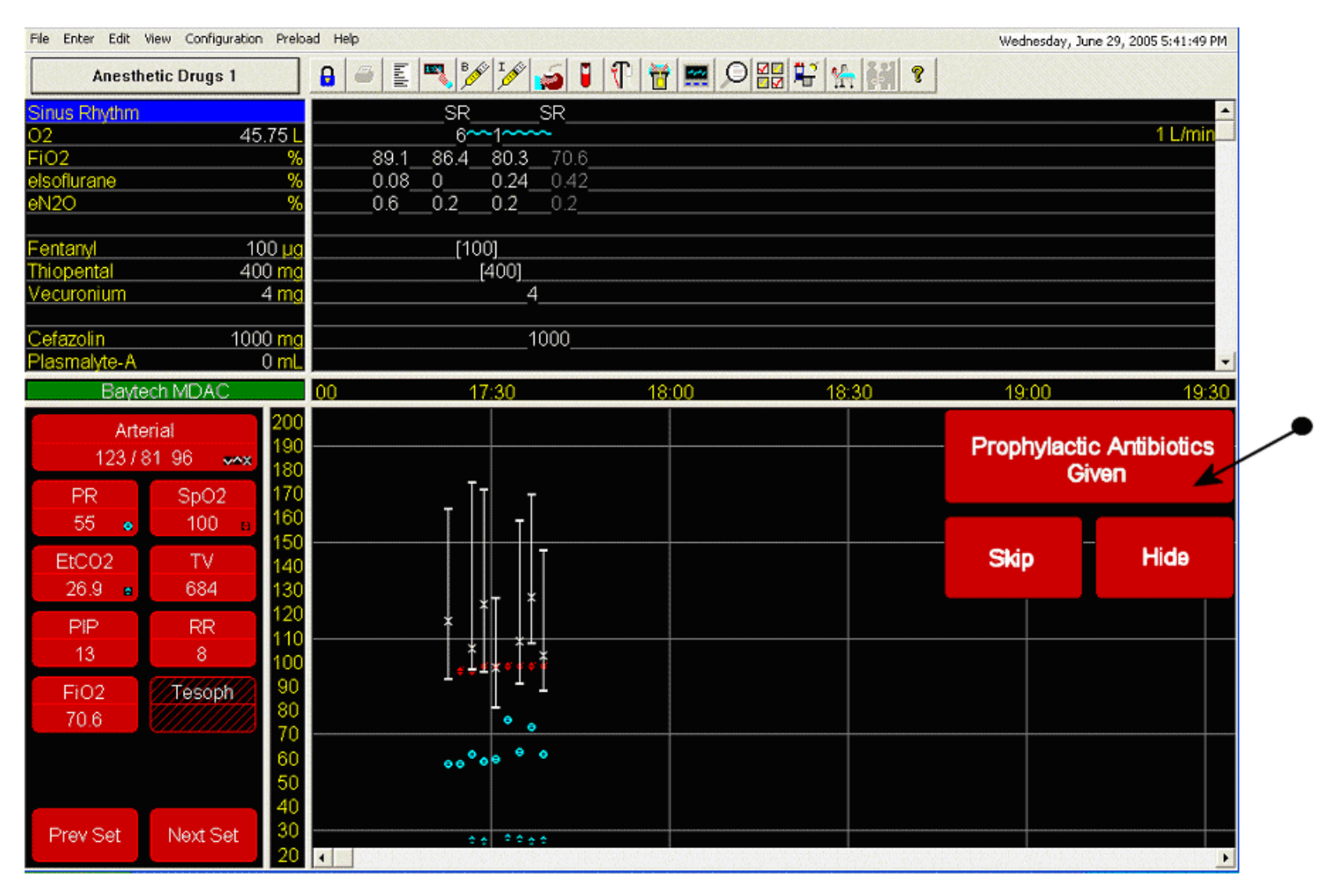
SCIP Adherence Infection Effect

	Nonadherent		Adherent		OR (95% CI)
	N	Infection Rate	N	Infection Rate	
S-INF-Core: all 3 original	44417	1.15%	154963	0.53%	0.86 (0.74-1.01)
S-INF: Full Set	59356	1.42%	158304	0.68%	0.85 (0.76-0.95)

Stulberg et al: JAMA 2010;303:2479-85

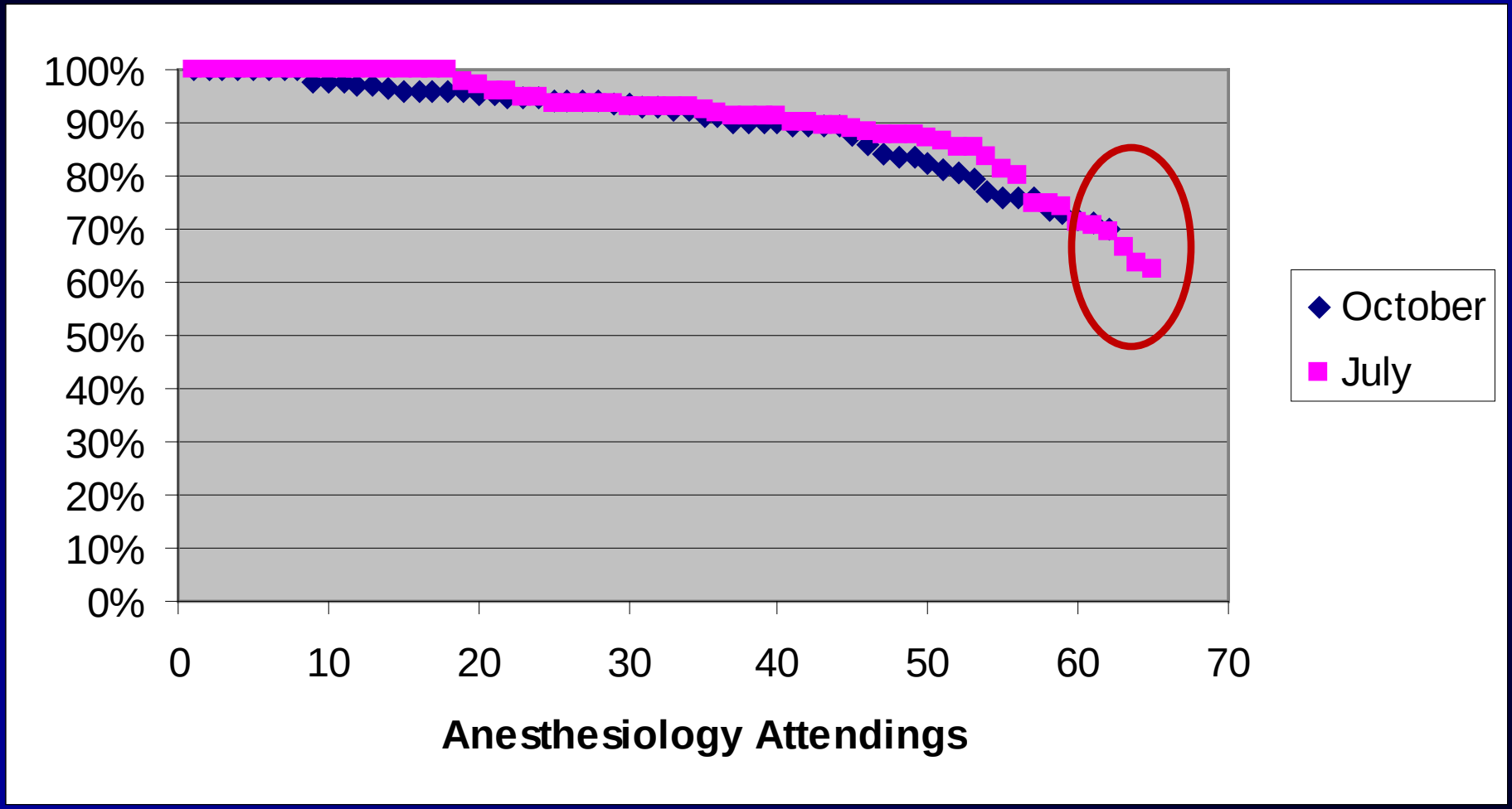
Antibiotics

Antibiotic Compliance Reminder



Wax et al: Anesth Analg 2007;104:1462-6

Antibiotic Compliance Reminder



Wax et al: Anesth Analg 2007;104:1462-6

An Anesthesia Information System Designed to Provide Physician-Specific Feedback Improves Timely Administration of Prophylactic Antibiotics

Michael O'Reilly, MD, MS*

AkkeNeel Talsma, PhD, RN†

Sharon VanRiper, MS, RN‡

Sachin Kheterpal, MD*

Richard Burney, MD§

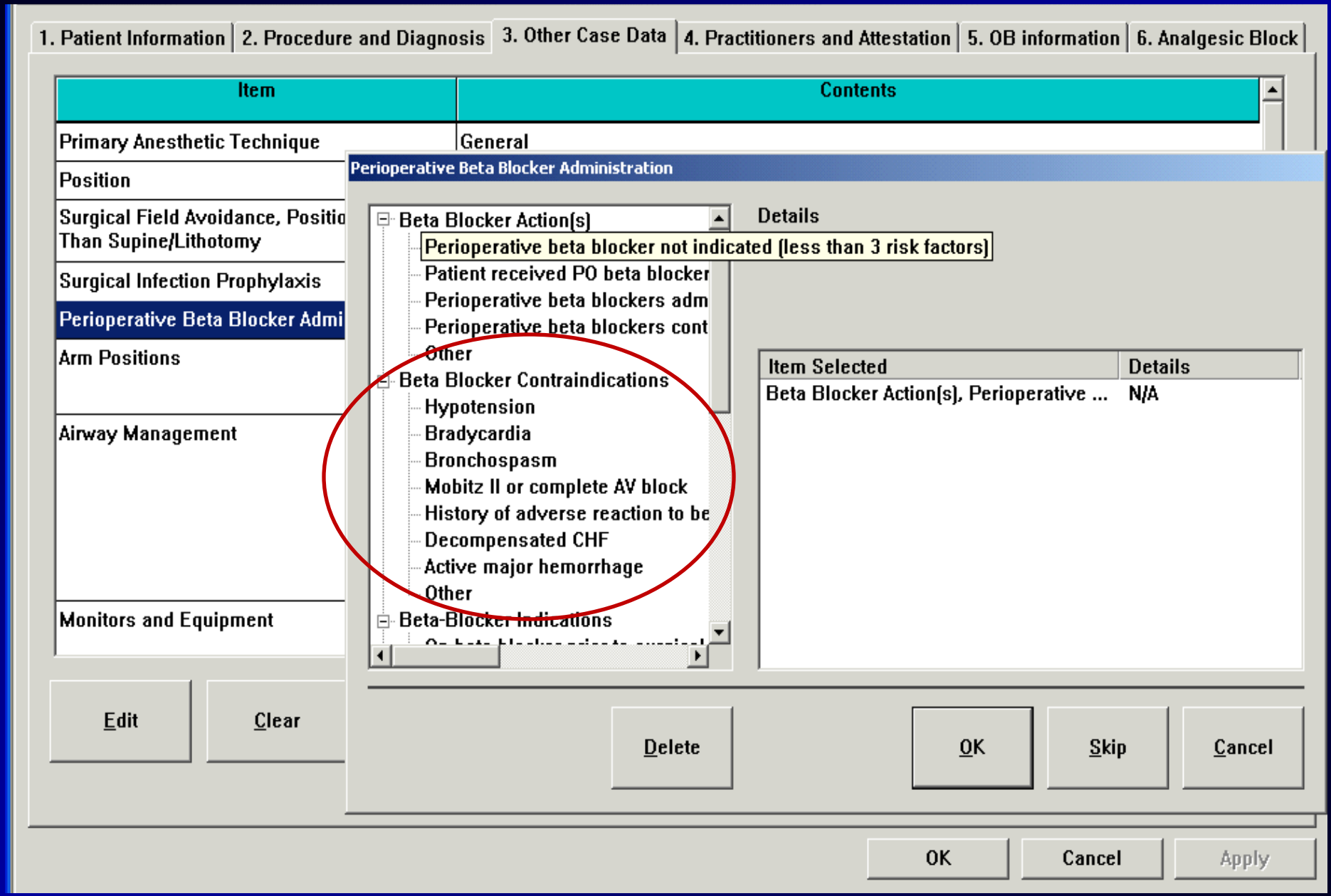
Surgical site infections are a frequent cause of morbidity and mortality and add significantly to the cost of care. One component of the national Surgical Infection Prevention (SIP) program is to ensure timely administration of prophylactic antibiotics, a key factor to reduce postoperative infection. Our anesthesia department decided to assume the responsibility for timing and administration of antibiotic prophylaxis and we initiated a multitiered approach to remind the anesthesiologist to administer the prophylactic antibiotics. We used our anesthesia clinical information system to implement practice guidelines for timely antibiotic administration and to generate reports from the database to provide specific feedback to individual care providers with the goal of ensuring that patients receive antibiotic prophylaxis within 1 h of incision. Before the initiation of this project, 69% of eligible patients received antibiotics within 60 min of the incision. After the program began, there was a steady increase in compliance to 92% 1 yr later. Provider-specific feedback increases compliance with practice guidelines related to timely administration of prophylactic antibiotics. Anesthesia information systems hold promise for implementing and monitoring new practice guidelines and the anesthesiologist may play a key role in influencing surgical outcomes by ensuring appropriate therapy that may not be directly related to anesthesia care.

(Anesth Analg 2006;103:908–12)

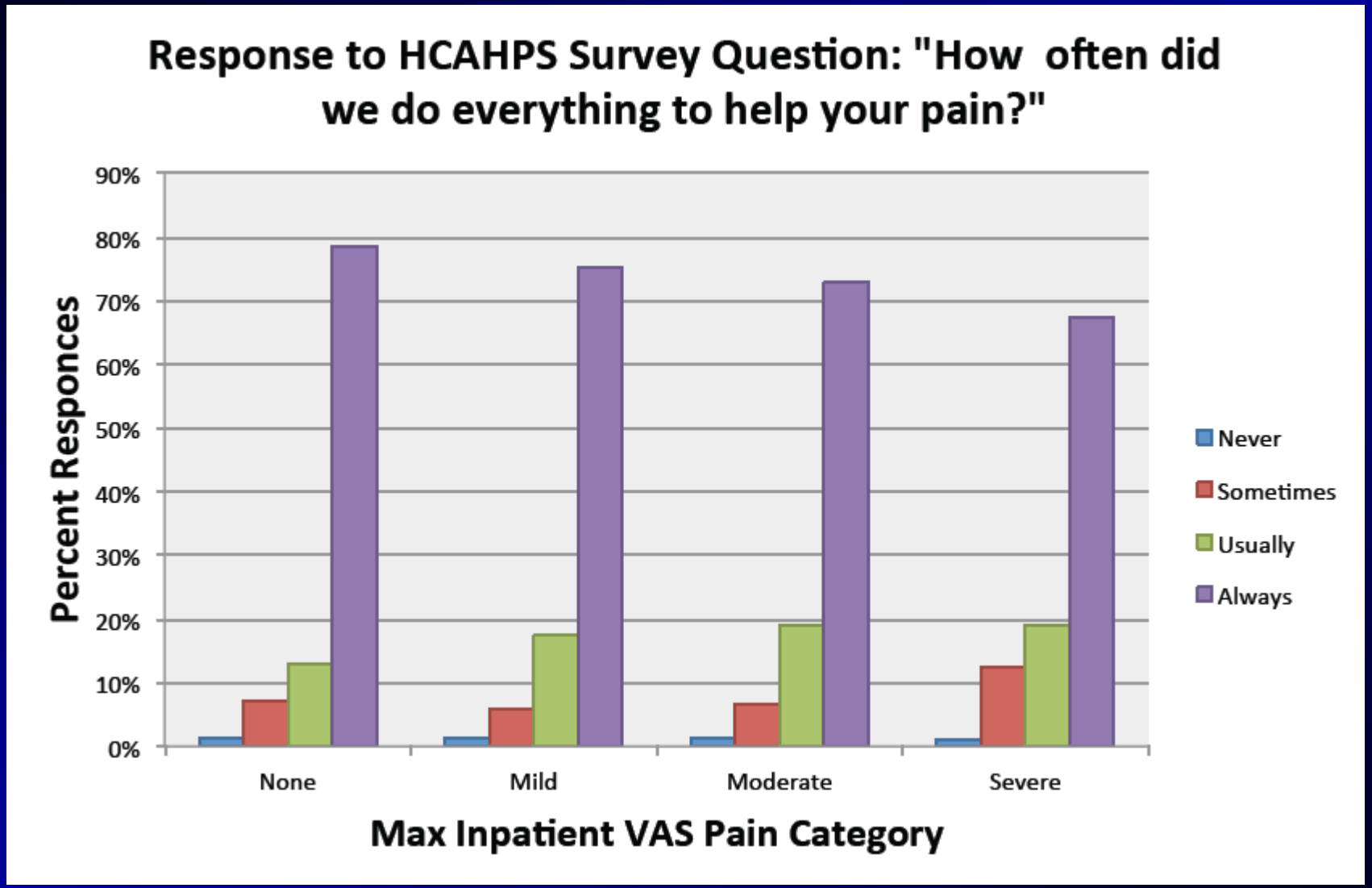
Physician Quality Reporting System (PQRS)

- Eligible professionals who successfully report a designated set of quality measures on claims may earn a bonus payment, subject to a cap, of 1.5% of total allowed charges for covered Medicare physician fee schedule services.
- Three elements in 2010:
  - Hypothermia prevention
  - Antibiotic timeliness
  - Central line insertion sterility checklist
- 0.5% revenue gain

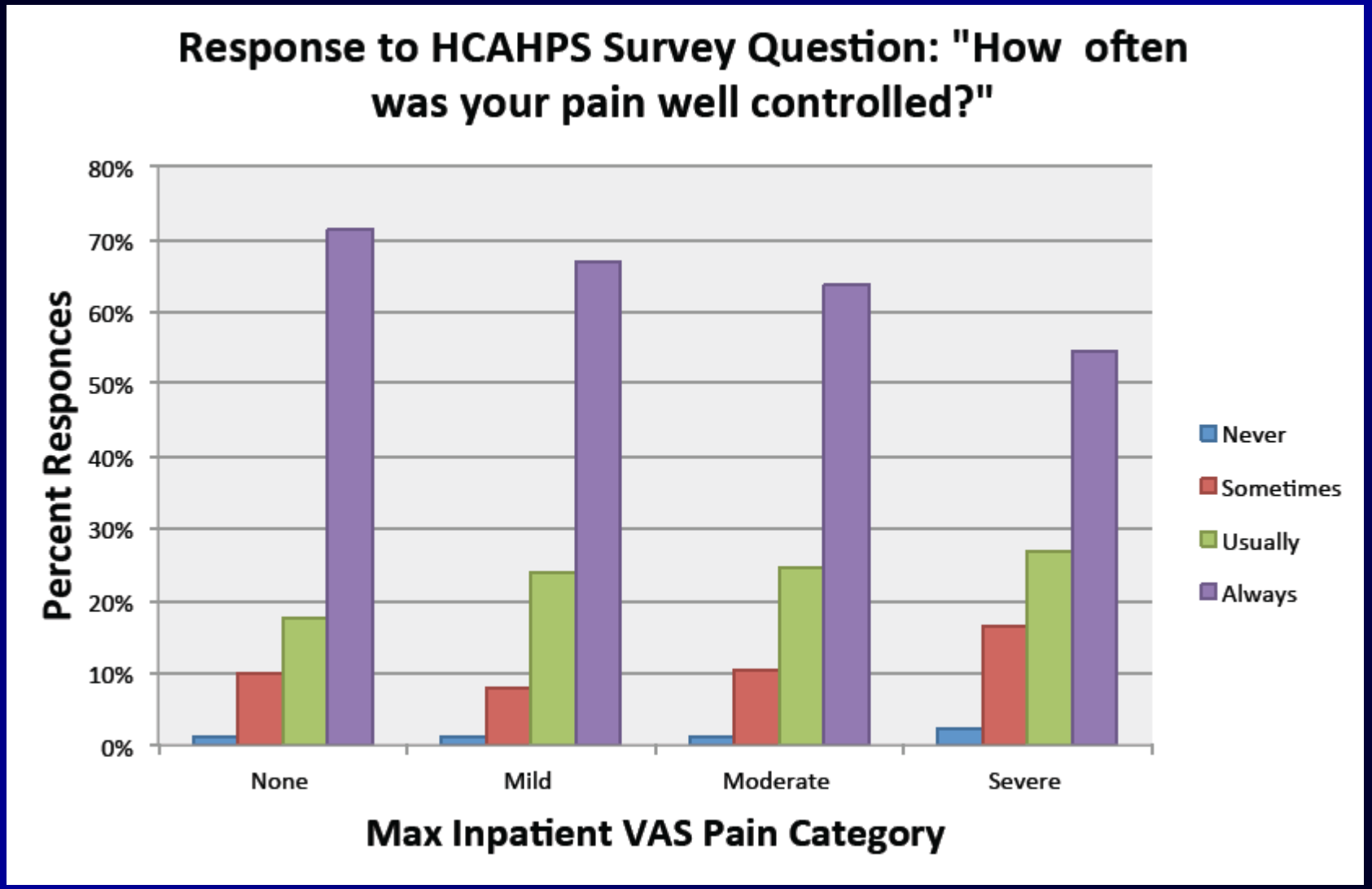
Beta Blockade


1. Patient Information
2. Procedure and Diagnosis
3. Other Case Data
4. Practitioners and Attestation
5. OB information
6. Analgesic Block
Item
Contents
Primary Anesthetic Technique
General
Position
Surgical Field Avoidance, Positio
Than Supine/Lithotomy
Surgical Infection Prophylaxis
Perioperative Beta Blocker Admi
Arm Positions
Airway Management
Monitors and Equipment
Perioperative Beta Blocker Administration
Beta Blocker Action(s)
Perioperative beta blocker not indicated (less than 3 risk factors)
Patient received PO beta blocker
Perioperative beta blockers adm
Perioperative beta blockers cont
Other
Beta Blocker Contraindications
Hypotension
Bradycardia
Bronchospasm
Mobitz II or complete AV block
History of adverse reaction to be
Decompensated CHF
Active major hemorrhage
Other
Beta-Blocker Indications
Details
Item Selected
Details
Beta Blocker Action(s), Perioperative ...
N/A
Edit
Clear
Delete
OK
Skip
Cancel
OK
Cancel
Apply

Pain Management



Am J Med Qual. 2012 Sep 25 [Epub]



Am J Med Qual. 2012 Sep 25 [Epub]

Predicting Inpatient Pain Severity

	Odds Ratio	Lower 95% CI	Upper 95% CI
Age (per 10yrs) for female	0.825	0.802	0.848
Age (per 10yrs) for male	0.769	0.746	0.793
LOS >7 days (vs. LOS=1)	7.259	6.495	8.113
LOS 3-7 days (vs. LOS=1)	4.336	3.934	4.779
LOS 1-3 days (vs. LOS=1)	2.476	2.254	2.721
African American vs. White	1.113	1.016	1.219
Latino vs. White	1.104	1.013	1.204
Asian vs. White	0.797	0.674	0.942
Other CNS drug vs. no CNS drug	1.247	1.142	1.363
Antidepressant vs. no CNS drug	1.226	1.110	1.354
Anxiolytic vs. no CNS drug	1.216	1.130	1.309

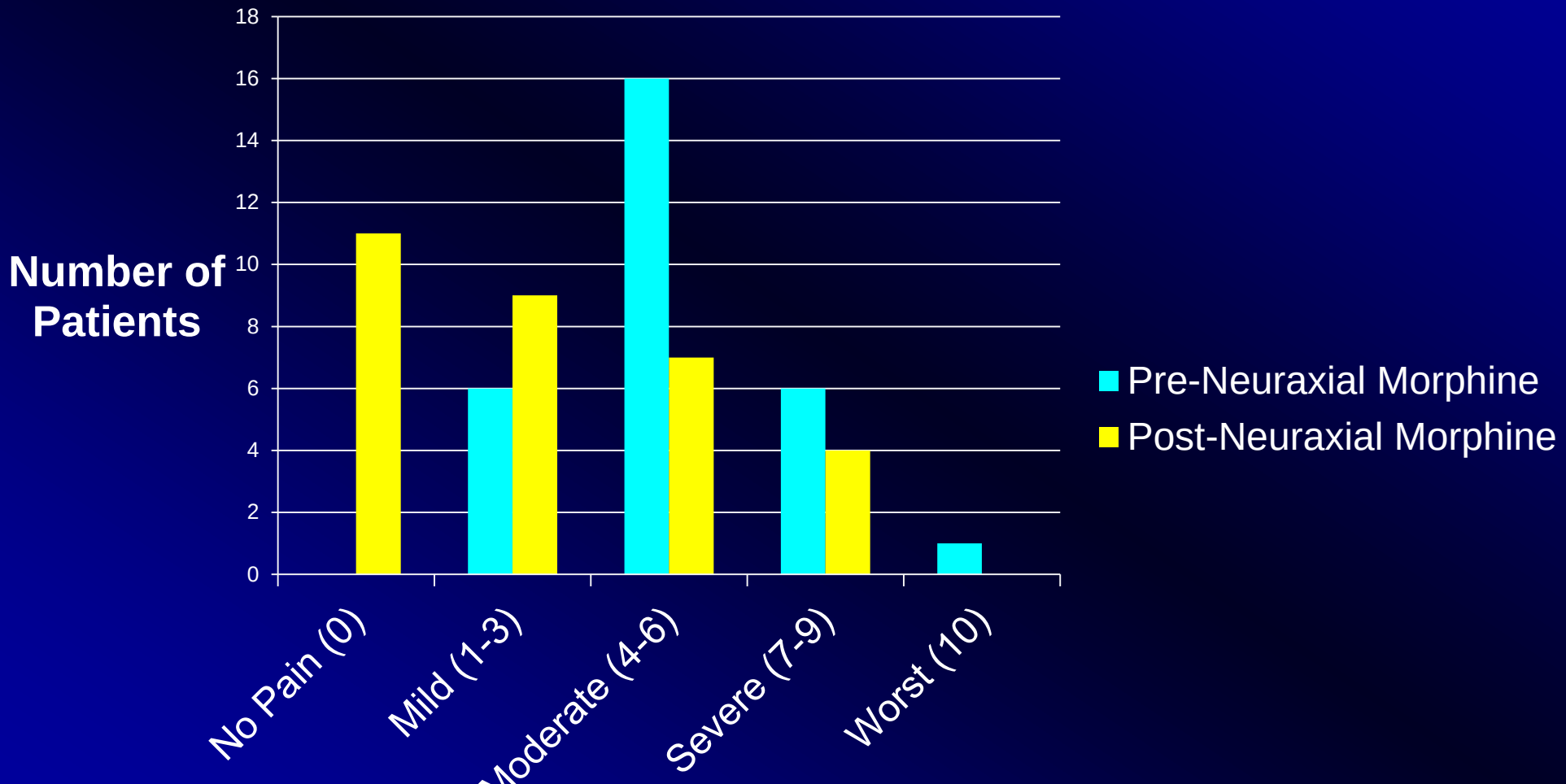
Am J Med Qual. 2012 Sep 25 [Epub]

Predicting Inpatient Pain Severity

(Odds Ratio vs. Medicine)	Odds Ratio	Lower 95% CI	Upper 95% CI
Orthopedics	7.676	6.345	9.285
Transplant Institute	5.705	2.914	11.168
Surgery	3.711	3.364	4.093
Dentistry	2.883	1.431	5.807
Neurosurgery	2.805	2.343	3.357
Rehabilitation	2.801	2.378	3.298
Urology	2.062	1.705	2.493
Radiology (Interventional)	1.932	1.272	2.936
Otolaryngology	1.440	1.147	1.809
Cardiothoracic Surgery	1.164	1.011	1.340
Gynecology	0.841	0.720	0.982
Neurology	0.727	0.584	0.905
Psychiatry	0.273	0.230	0.325

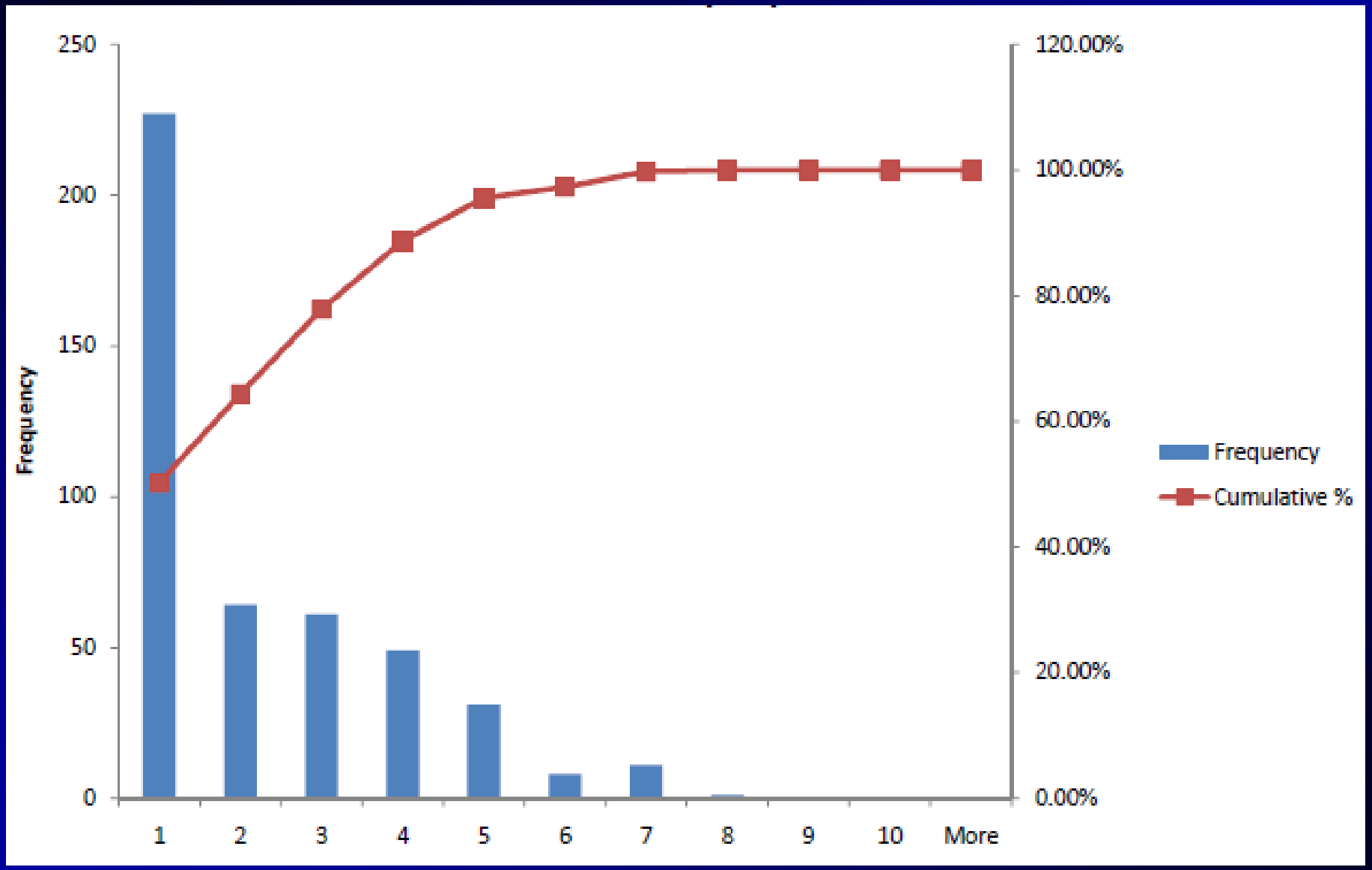
Am J Med Qual. 2012 Sep 25 [Epub]

Orthopedic Nursing Unit



Am J Med Qual. 2012 Sep 25 [Epub]

PACU Discharge Pain Scores



Pain Buster Rounds

MSH Pain Score Prediction Calculator

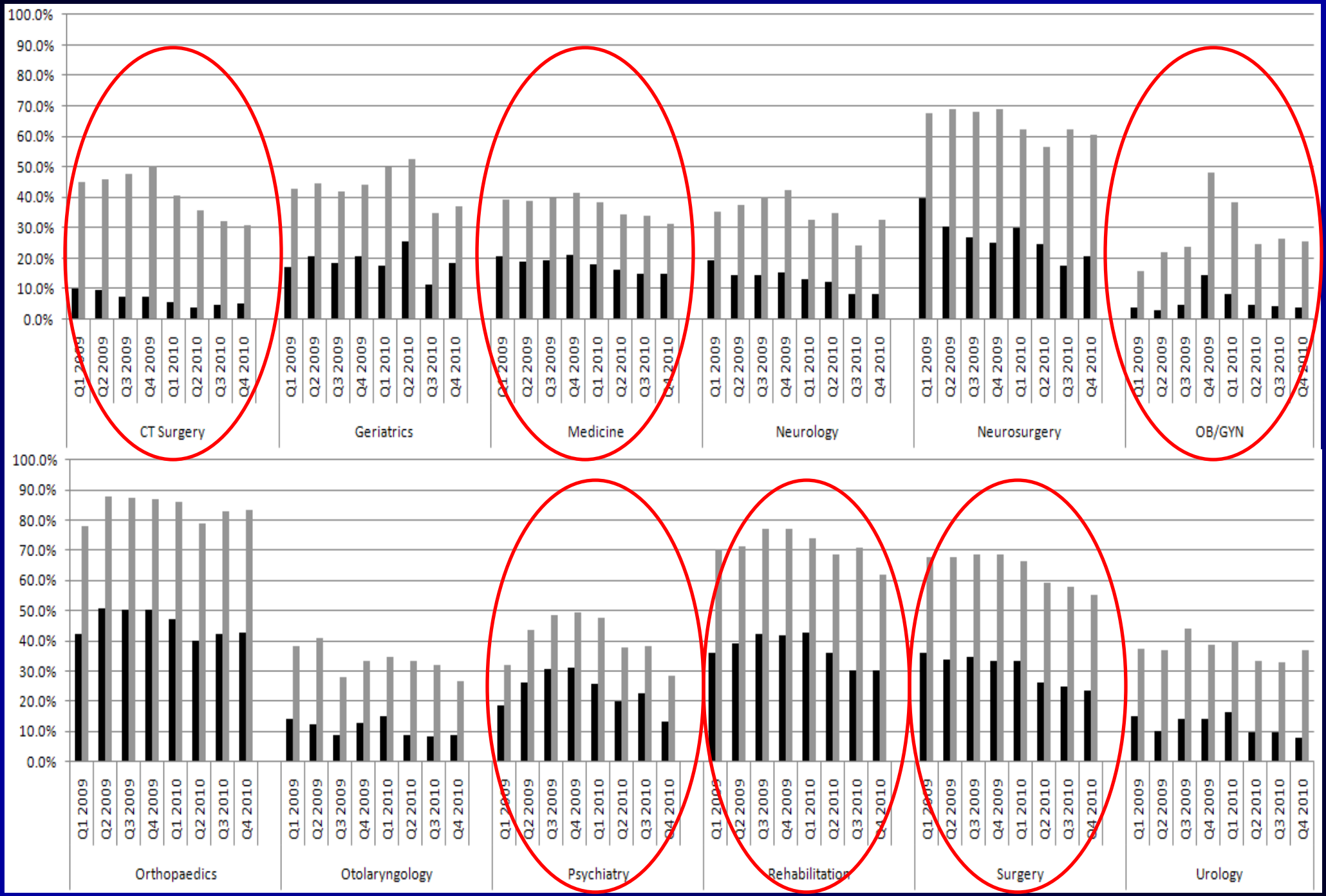
MRN Last Name Date-of-Birth	1234567 Smith 01/01/1930
Age	80
Gender	(•) Male ( ) Female
Length of Stay	(•) 1-3 Days ( ) 4-7 Days ( ) 8+ Days
Race	( ) White/Caucasian ( ) Hispanic/Latino ( ) African-American/Black (•) Asian ( ) Other
Department	Orthopaedics
Medications	[ ] No CNS Medications [x] Anti-Depressant [ ] Anxiolytic [ ] Anti-Psychotic [ ] Other CNS Medications

Probability of Moderate/Severe Pain 65 %

MSH Pain Score Prediction Calculator

MRN Last Name Date-of-Birth	1234567 Smith 01/01/1970
Age	40
Gender	( ) Male (•) Female
Length of Stay	( ) 1-3 Days (•) 4-7 Days ( ) 8+ Days
Race	(•) White/Caucasian ( ) Hispanic/Latino ( ) African-American/Black ( ) Asian ( ) Other
Department	Orthopaedics
Medications	[x] No CNS Medications [ ] Anti-Depressant [ ] Anxiolytic [ ] Anti-Psychotic [ ] Other CNS Medications

Probability of Moderate/Severe Pain 92 %

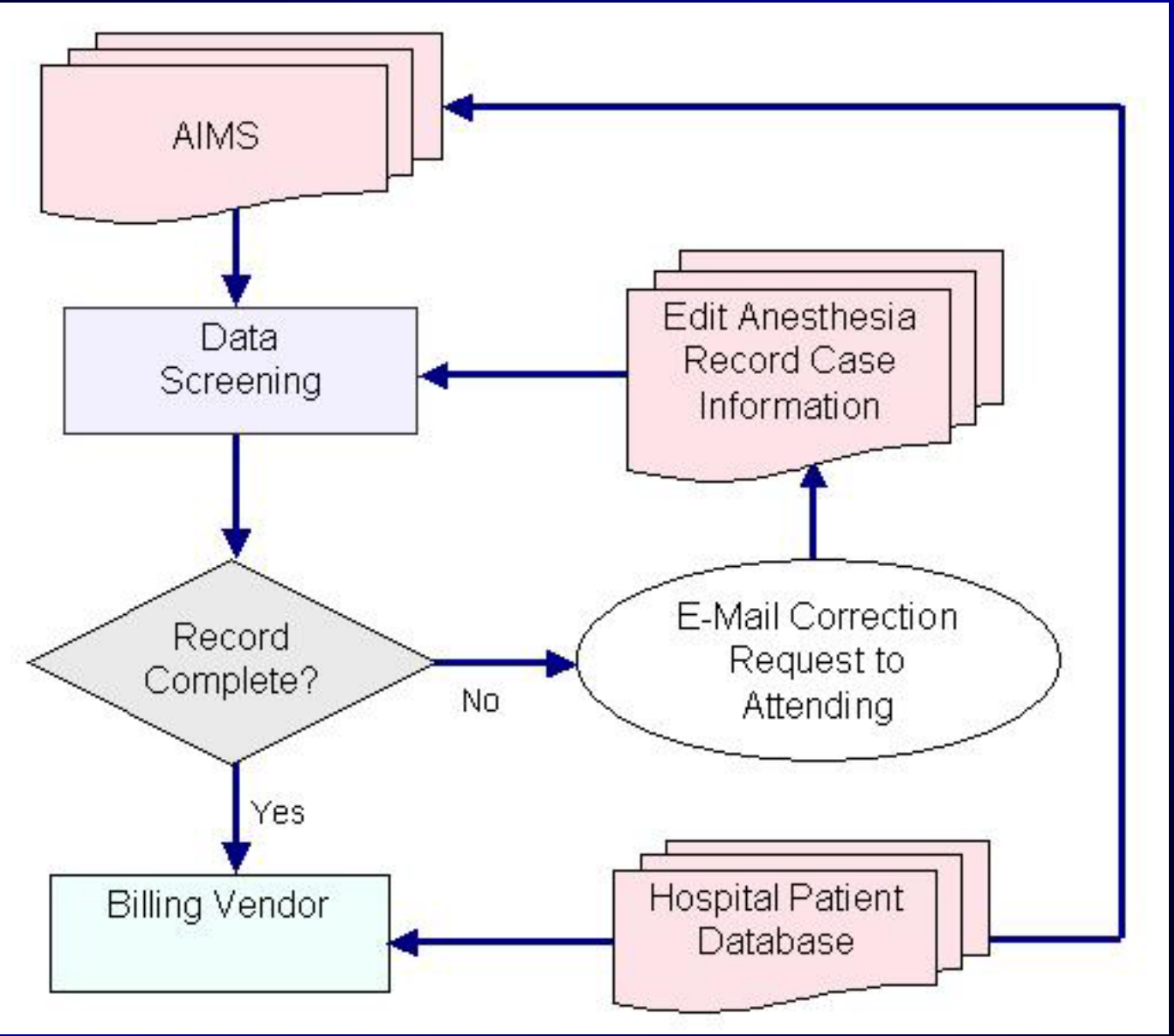

100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Q1 2009
Q2 2009
Q3 2009
Q4 2009
Q1 2010
Q2 2010
Q3 2010
Q4 2010
CT Surgery
Geriatrics
Medicine
Neurology
Neurosurgery
OB/GYN
Orthopaedics
Otolaryngology
Psychiatry
Rehabilitation
Surgery
Urology

Administrative Use of AIMS

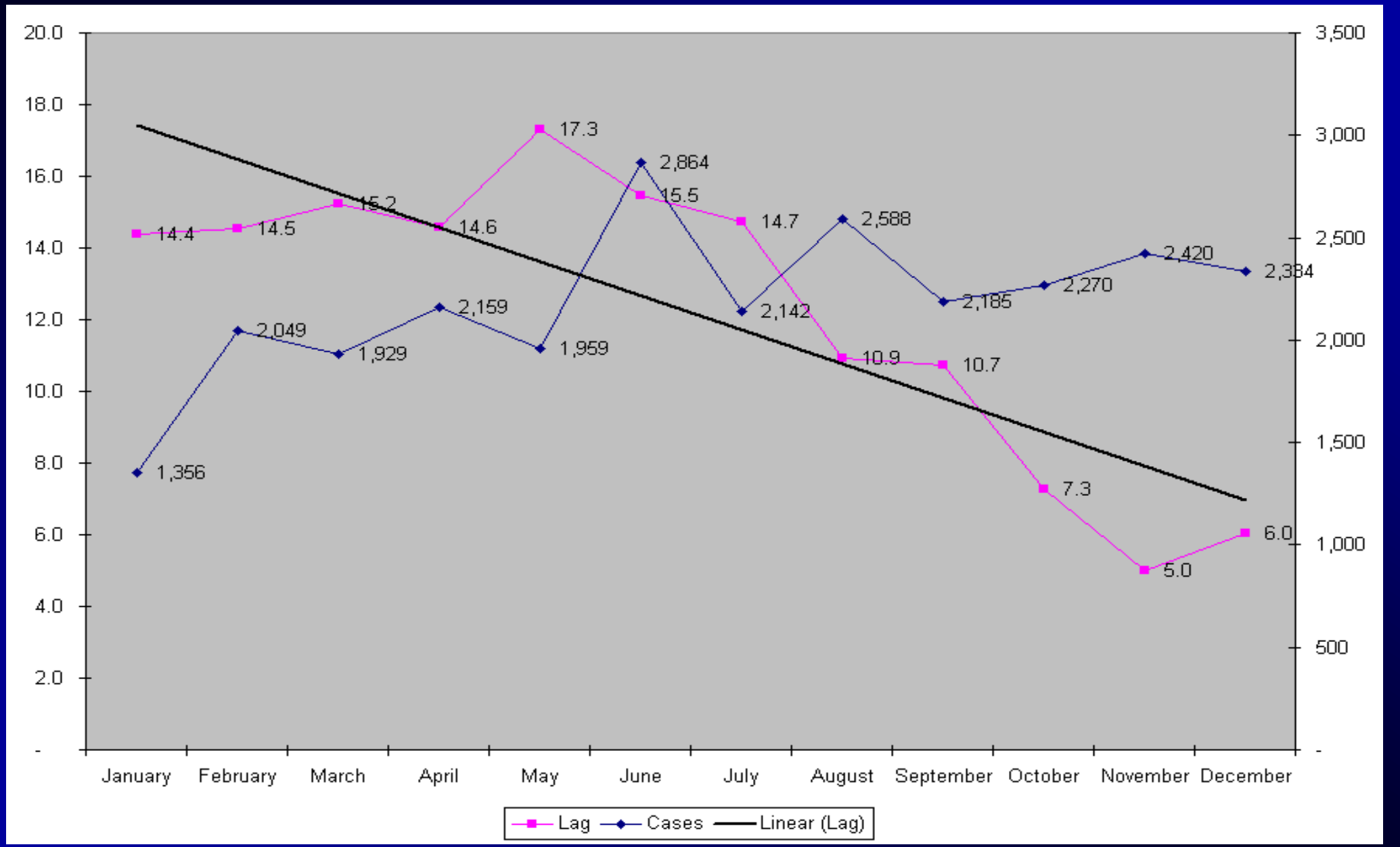
Providing Value to the Hospital

Hospital Quality Reports

- Returns to OR
  - Second operation within same hospitalization
- Anastomotic leak
- Surgical operation log
- PACU statistics and pain at discharge
- 48 hour post-anesthesia mortality
- Postop complications (standard CMS list)
- CLABS prevention program compliance
- Central line education report
- OR utilization reports



Anesthesiology 2006;105:179-86



Anesthesiology 2006;105:179-86

A Mission-Based Productivity Compensation Model for an Academic Anesthesiology Department

David L. Reich, MD

Maria Galati, MBA

Marina Krol, PhD

Carol A. Bodian, Dr.PH

Ronald A. Kahn, MD

INTRODUCTION: We replaced a nearly fixed-salary academic physician compensation model with a mission-based productivity model with the goal of improving attending anesthesiologist productivity.

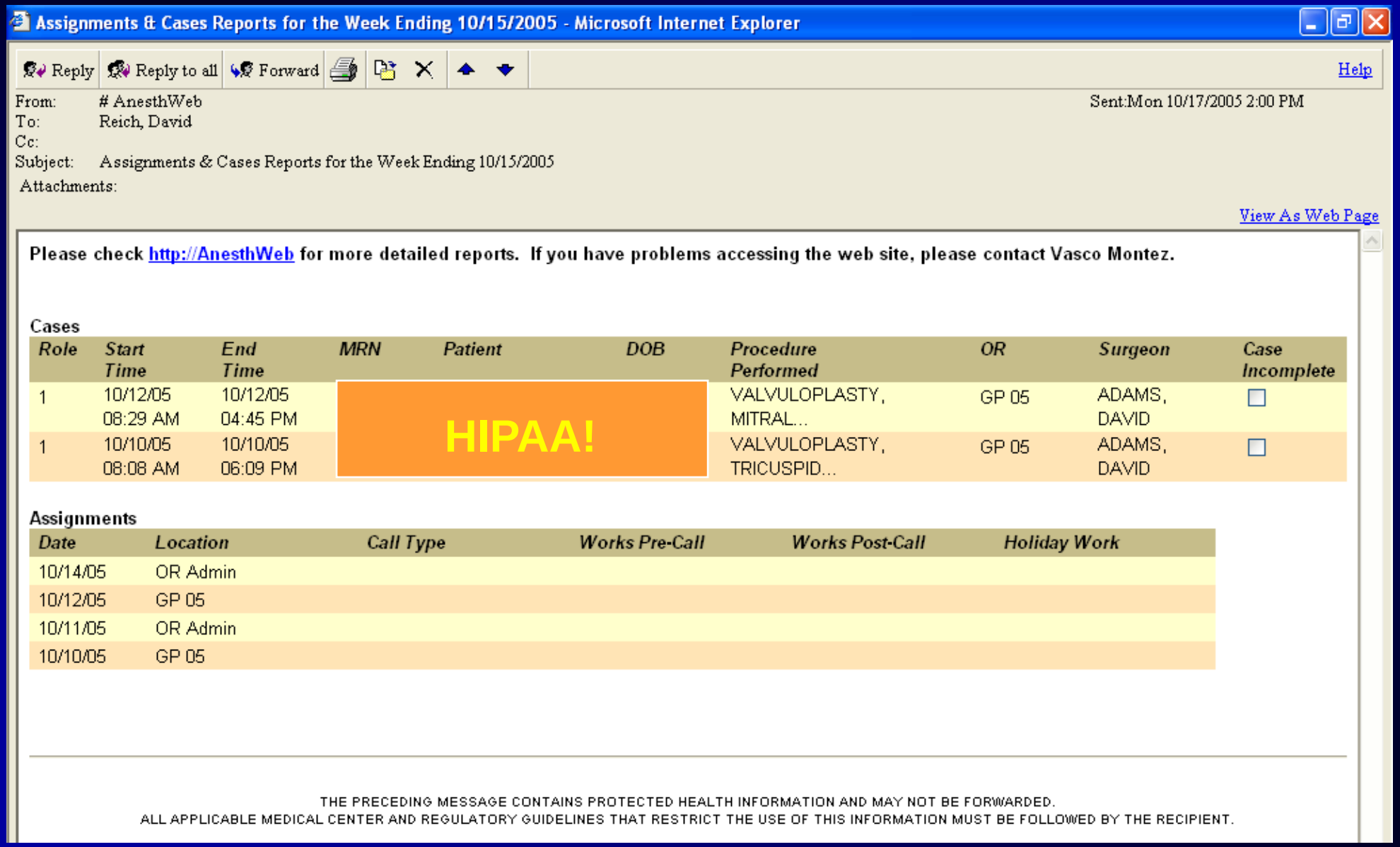
METHODS: The base salary system was stratified according to rank and clinical experience. The supplemental pay structure was linked to electronic patient records and a scheduling database to award points for clinical activity; educational, research, and administrative points systems were constructed in parallel. We analyzed monthly American Society of Anesthesiologist (ASA) unit data for operating room activity and physician compensation from 2000 through mid-2007, excluding the 1-yr implementation period (July 2004–June 2005) for the new model.

RESULTS: Comparing 2005–2006 with 2000–2004, quarterly ASA units increased by 14% ($P = 0.0001$) and quarterly ASA units per full-time equivalent increased by 31% ($P < 0.0001$), while quarterly ASA units per anesthetizing location decreased by 10% ($P = 0.046$). Compared with a baseline year (2001), Instructor and Assistant Professor faculty compensation increased more than Associate Professor and Professor faculty ($P < 0.001$) in both pre- and postimplementation periods. There were larger compensation increases for the postimplementation period compared with preimplementation across faculty rank groupings ($P < 0.0001$). Academic and educational output was stable.

DISCUSSION: Implementing a productivity-based faculty compensation model in an academic department was associated with increased mean supplemental pay with relatively fewer faculty. ASA units per month and ASA units per operating room full-time equivalent increased, and these metrics are the most likely drivers of the increased compensation. This occurred despite a slight decrease in clinical productivity as measured by ASA units per anesthetizing location. Academic and educational output was stable.

Anesth Analg 2008;107:1981-8

Weekly Feedback



Assignments & Cases Reports for the Week Ending 10/15/2005 - Microsoft Internet Explorer

Reply | Reply to all | Forward | Help

From: # AnesthWeb
To: Reich, David
Cc:
Subject: Assignments & Cases Reports for the Week Ending 10/15/2005
Attachments:

Sent:Mon 10/17/2005 2:00 PM

View As Web Page

Please check http://AnesthWeb for more detailed reports. If you have problems accessing the web site, please contact Vasco Montez.

Cases

Role	Start Time	End Time	MRN	Patient	DOB	Procedure Performed	OR	Surgeon	Case Incomplete
1	10/12/05 08:29 AM	10/12/05 04:45 PM				VALVULOPLASTY, MITRAL...	GP 05	ADAMS, DAVID	☐
1	10/10/05 08:08 AM	10/10/05 06:09 PM				VALVULOPLASTY, TRICUSPID...	GP 05	ADAMS, DAVID	☐

HIPAA!

Assignments

Date	Location	Call Type	Works Pre-Call	Works Post-Call	Holiday Work
10/14/05	OR Admin				
10/12/05	GP 05				
10/11/05	OR Admin				
10/10/05	GP 05				

THE PRECEDING MESSAGE CONTAINS PROTECTED HEALTH INFORMATION AND MAY NOT BE FORWARDED.
ALL APPLICABLE MEDICAL CENTER AND REGULATORY GUIDELINES THAT RESTRICT THE USE OF THIS INFORMATION MUST BE FOLLOWED BY THE RECIPIENT.

Table 4. Missing Data Report Elements

1. Service date
2. Internal case ID
3. Case number
4. Medical record number
5. Patient name
6. Patient date of birth
7. Attending anesthesiologist 1
8. Attending anesthesiologist 1 e-signature
9. Attestation comments
10. Attending anesthesiologist 2
11. Relief date/time 1
12. Attending anesthesiologist 2 e-signature
13. Attending anesthesiologist 3
14. Attending anesthesiologist 3 e-signature
15. Relief date/time 2
16. CRNA 1 e-signature
17. CRNA 2 e-signature
18. ASA classification
19. Performed procedure
20. Primary anesthetic technique
21. Preoperative diagnosis
22. Postoperative diagnosis
23. Surgeon
24. Anesthesia start time
25. Anesthesia end time

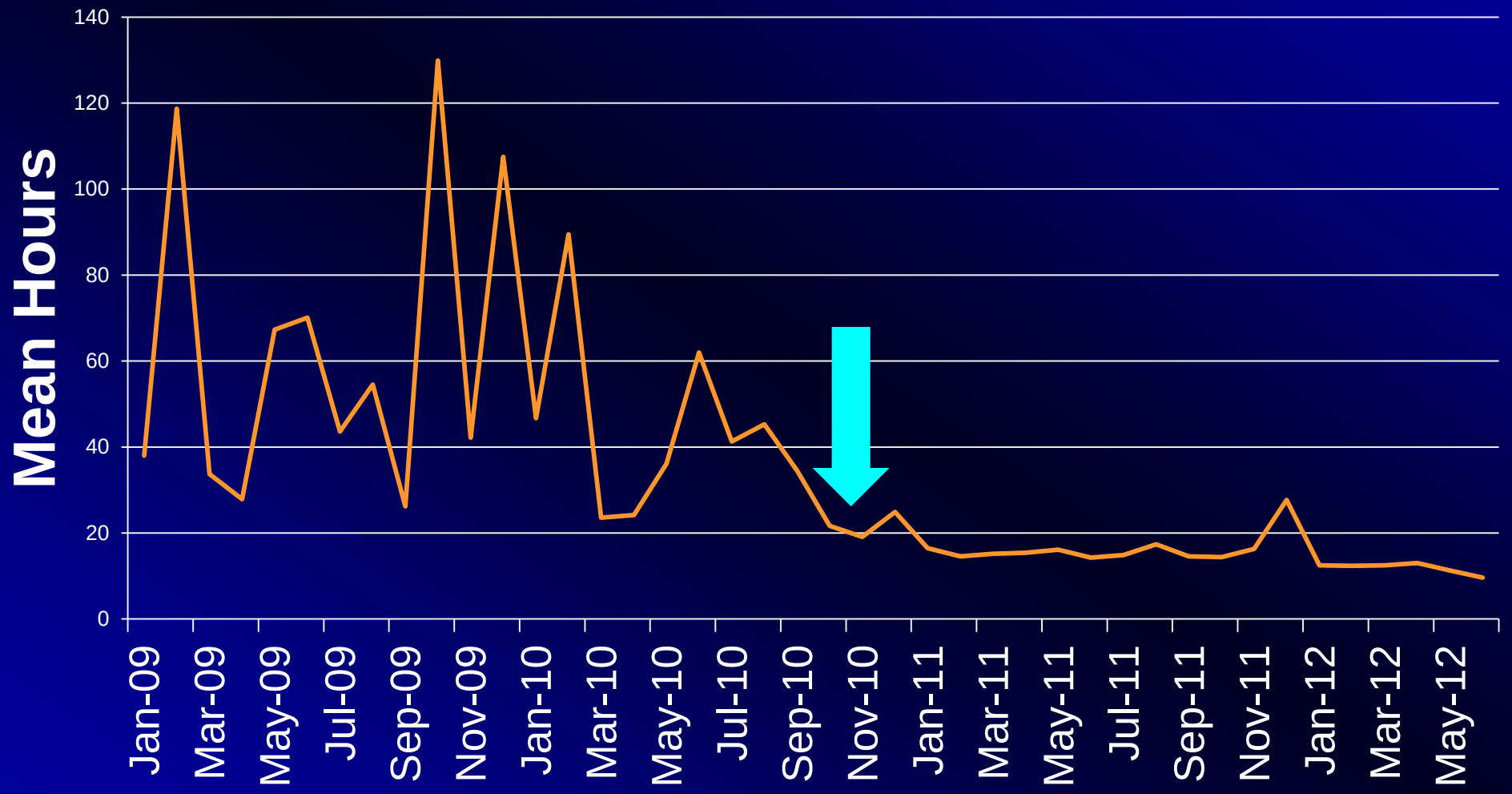
Billing Module from AIMS

Anesthesiology
2006;105:179-86

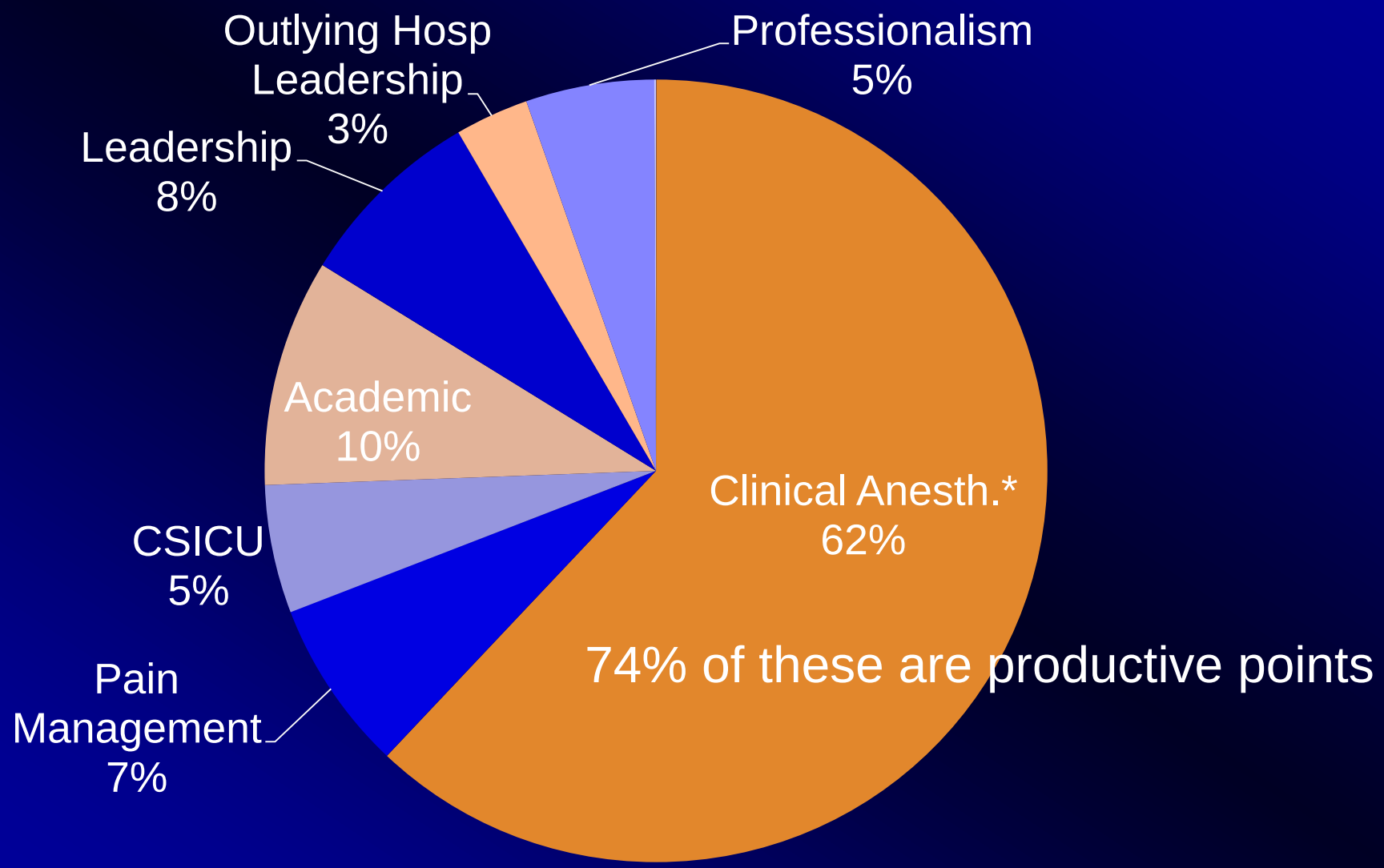
Daily Clinical Productivity

Case Number	Start Time	End Time	Points	Concurrency Adjustment	PostOp Note Lateness	Call Related	Completeness	Final Points
						Cardiac 1	N/A	450
						Worked Pre-Call	N/A	450
1	9:28	10:34	195	0.97	1		1	190
2	20:00	23:24	310	N/A after 1800	1		1	310
3	9:00	10:43	255	0.97	1		1	248
4	17:45	18:00	27	0.97	1		1	27
4	18:00	21:28	378	N/A after 1800	1		1	378
5	11:10	15:25	420	0.97	1		1	409
6	15:50	18:00	206	0.97	0.9		1	181
6	18:00	20:15	214	N/A after 1800	0.9		1	193
							Total	2836

Postoperative Note Latency



2013 Points Budget: 27.8m points



Comparison of the Pre- and Post-Implementation Periods

	MEDIAN		p-value
	Pre-Implementation	Post-Implementation	
Average Monthly ASA Units	43,563	49,594	.0001
Average Monthly ASA Units per OR FTE	601	790	<.0001
Average Monthly ASA Units per Location	1268	1147	.046

Anesth Analg 2008;107:1981-8

Mean Faculty Salary Ratios by Rank Grouping c/w 2001

Rank Grouping	Pre-Implementation (2003-2004)	Post-Implementation (2006-2007)[&]
Instructors and Assistant Professors*	1.12	1.57
Associate and Full Professors	1.01	1.35

*Higher mean salary increase for Instructors/Assistant Professors compared with Associate and Full Professors across periods ($p<0.001$)

[&]Higher mean salary increase for post-implementation period compared with pre-implementation across rank groupings ($p<.0001$).

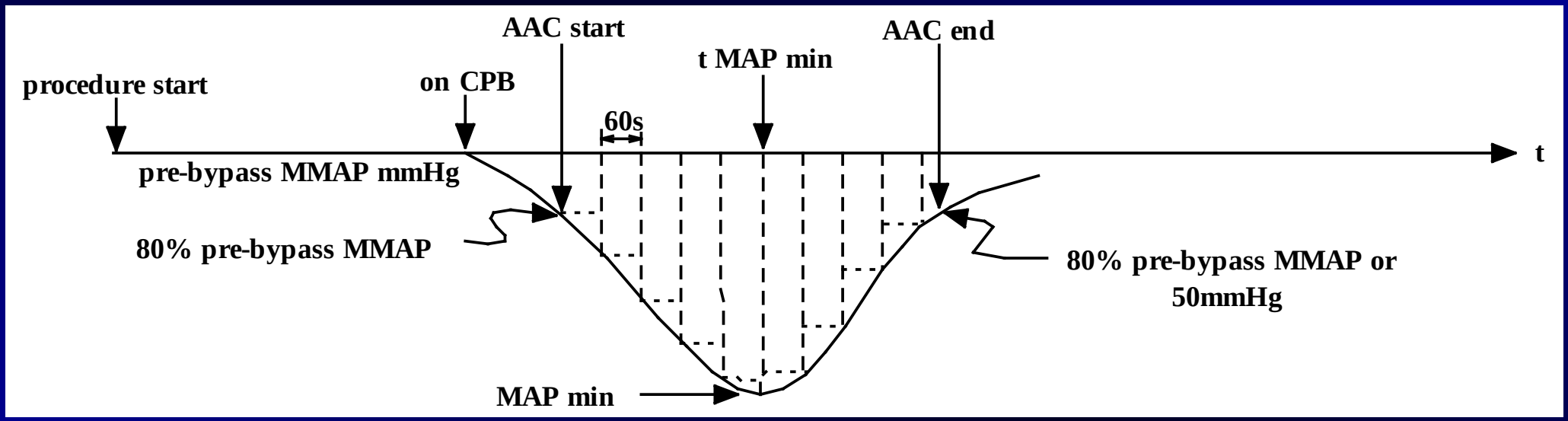
Anesth Analg 2008;107:1981-8

Administrative

- ACGME report automatic generation
- EPIC interface
- Tracking system
  - OR Control Desk, Family Waiting Room, Assessment Area, PACU's, Bed assignment unit, Cardiac White Board, Event Notification
- Scheduling system
  - Daily assignments
  - Night and weekend calls
  - Time off
  - Web displays and reports
- Personnel system

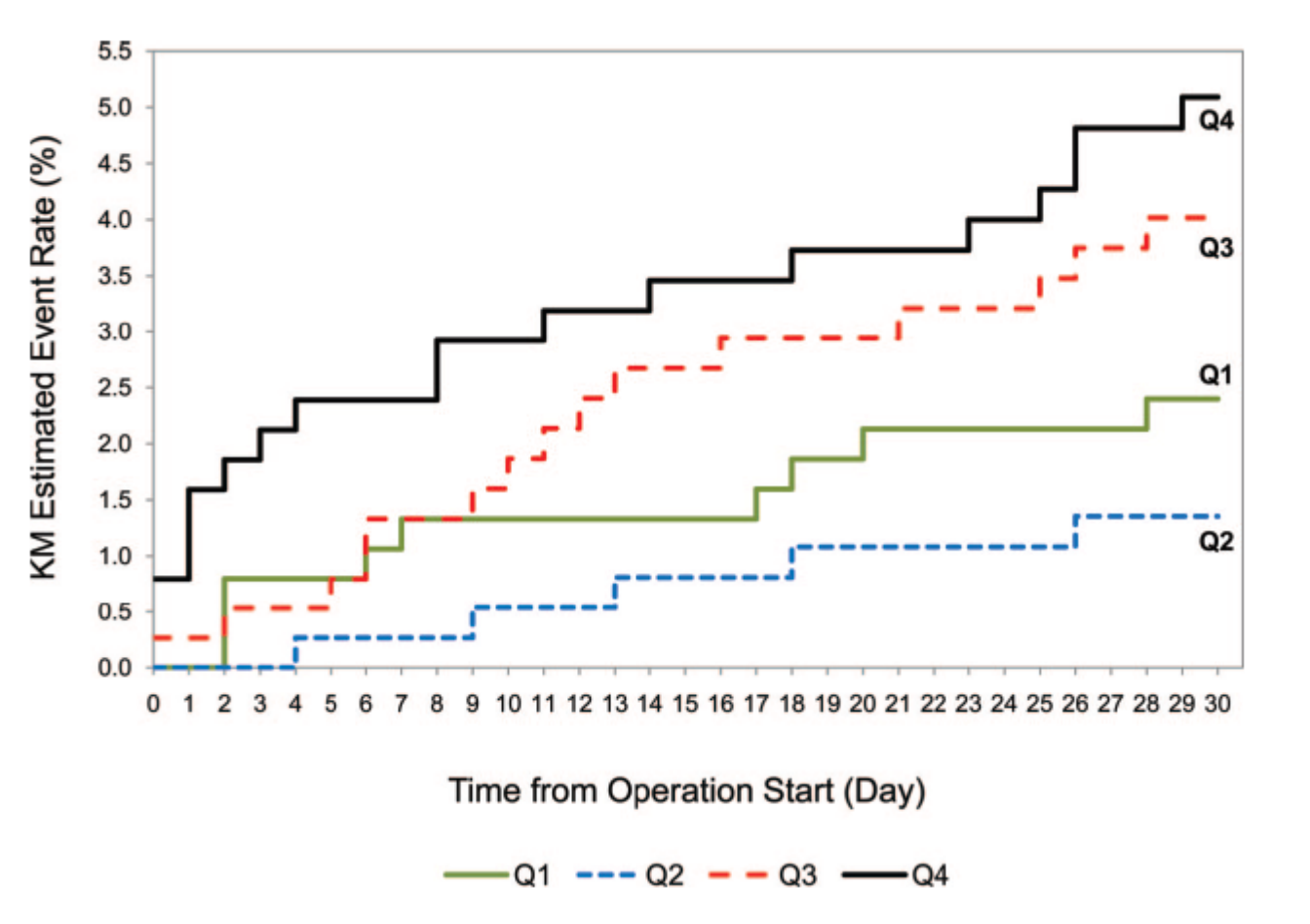
Research

Onset of CPB Hypotension



Levin MA et al: Circulation 2009 Oct 12 [Epub]

BP Excursions and Mortality

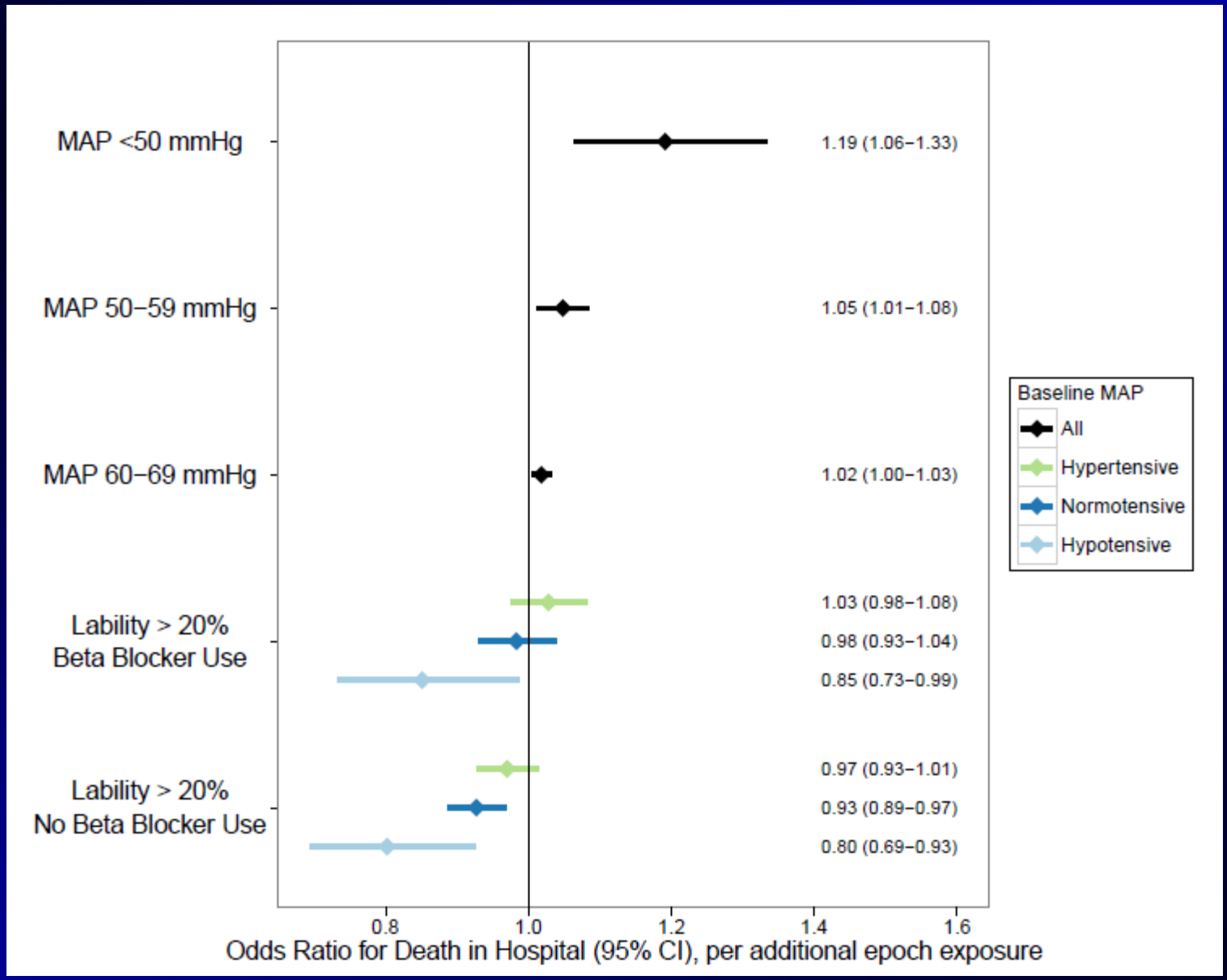


Anesth Analg 2011;113:19–30

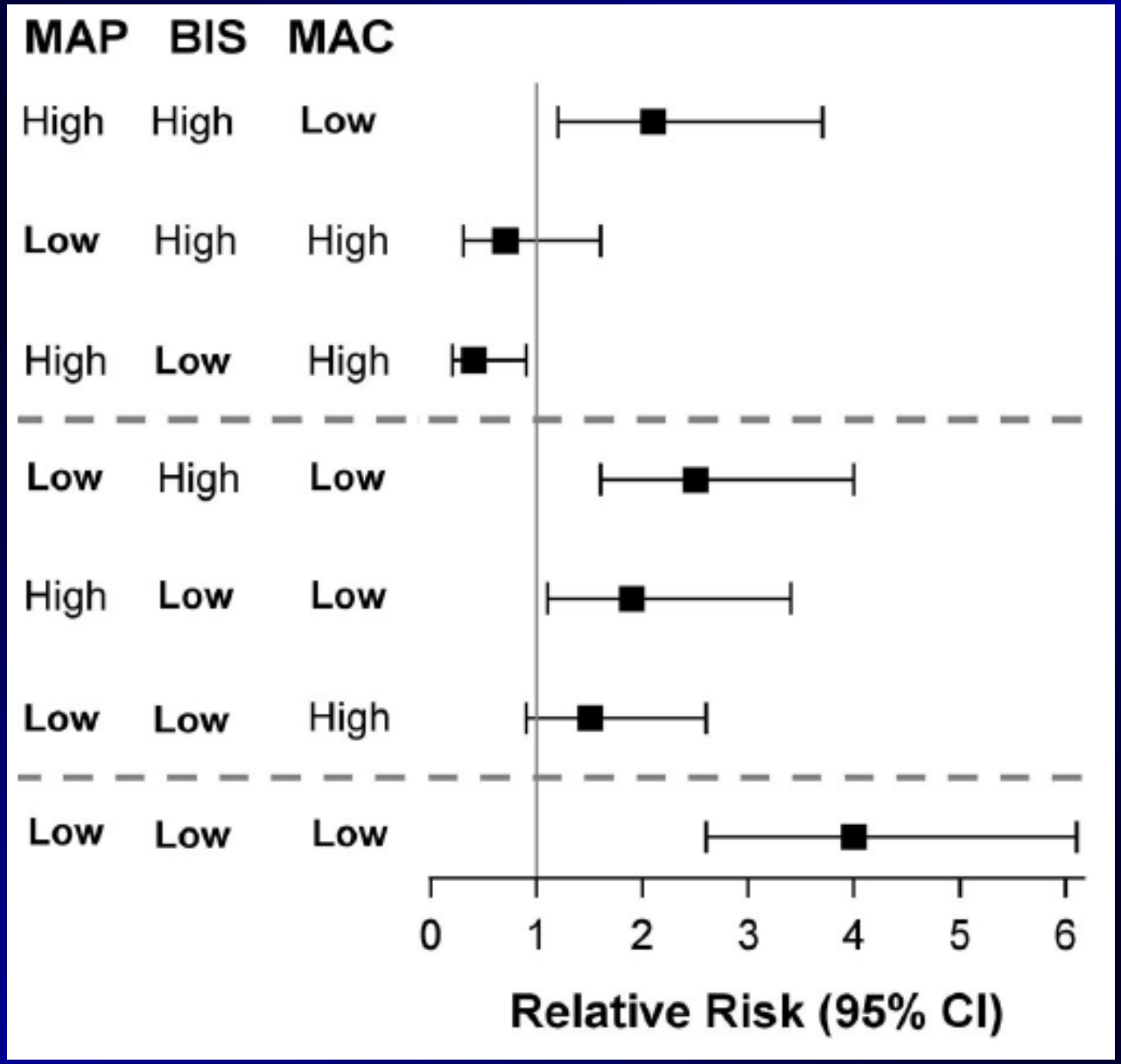
Independent Predictors of Hospital Mortality

Variable	Odds Ratio	P-value
ASA 3-5	47.4 [6.4-349]	0.002
Propofol Induction	0.24 [0.12-0.48]	<0.0001
Fentanyl Dosage	--	0.83
Post-Induct Hypotension	2.3 [0.95-5.5]	0.066

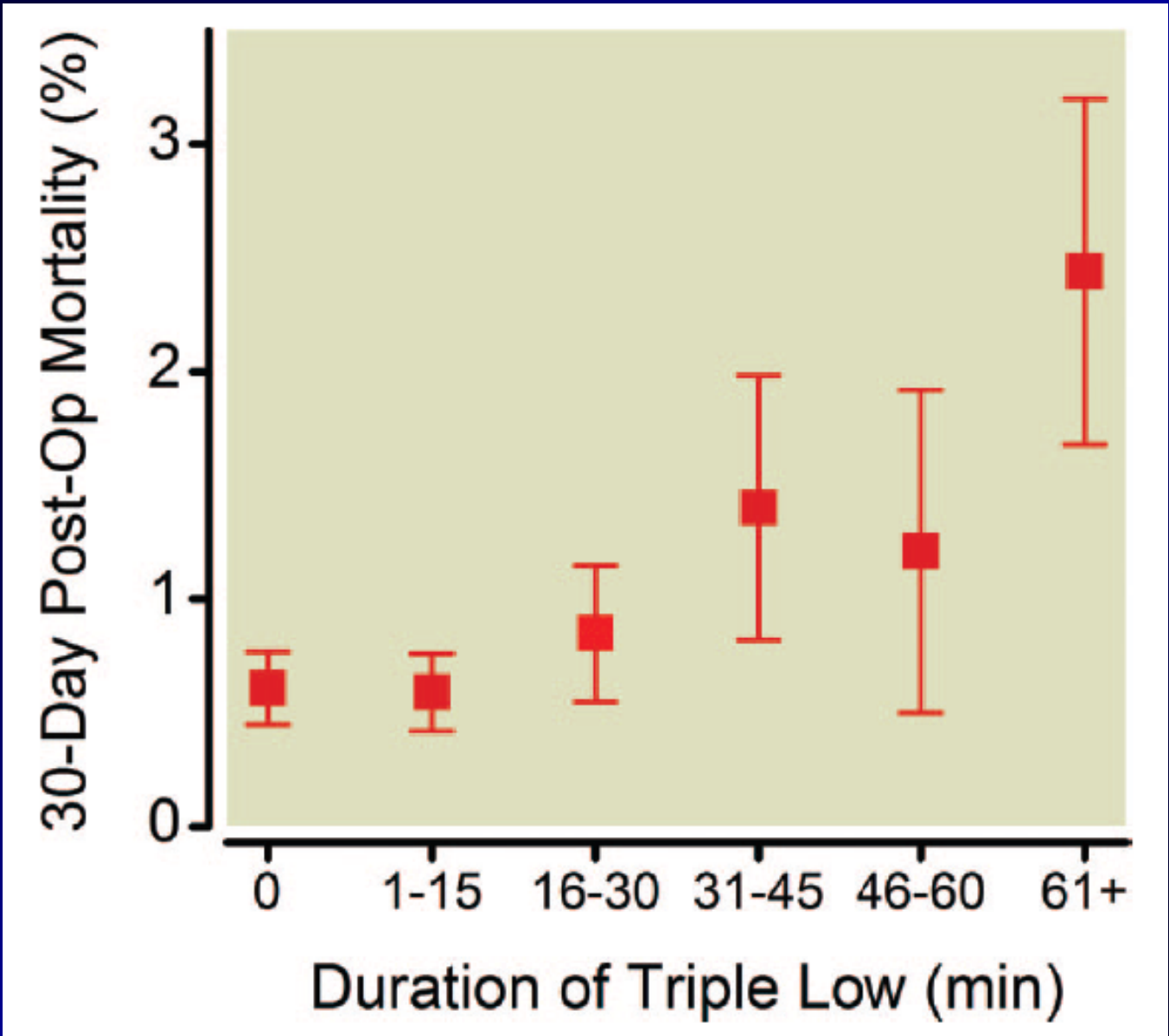
Anesth Analg 2005;10:622-8



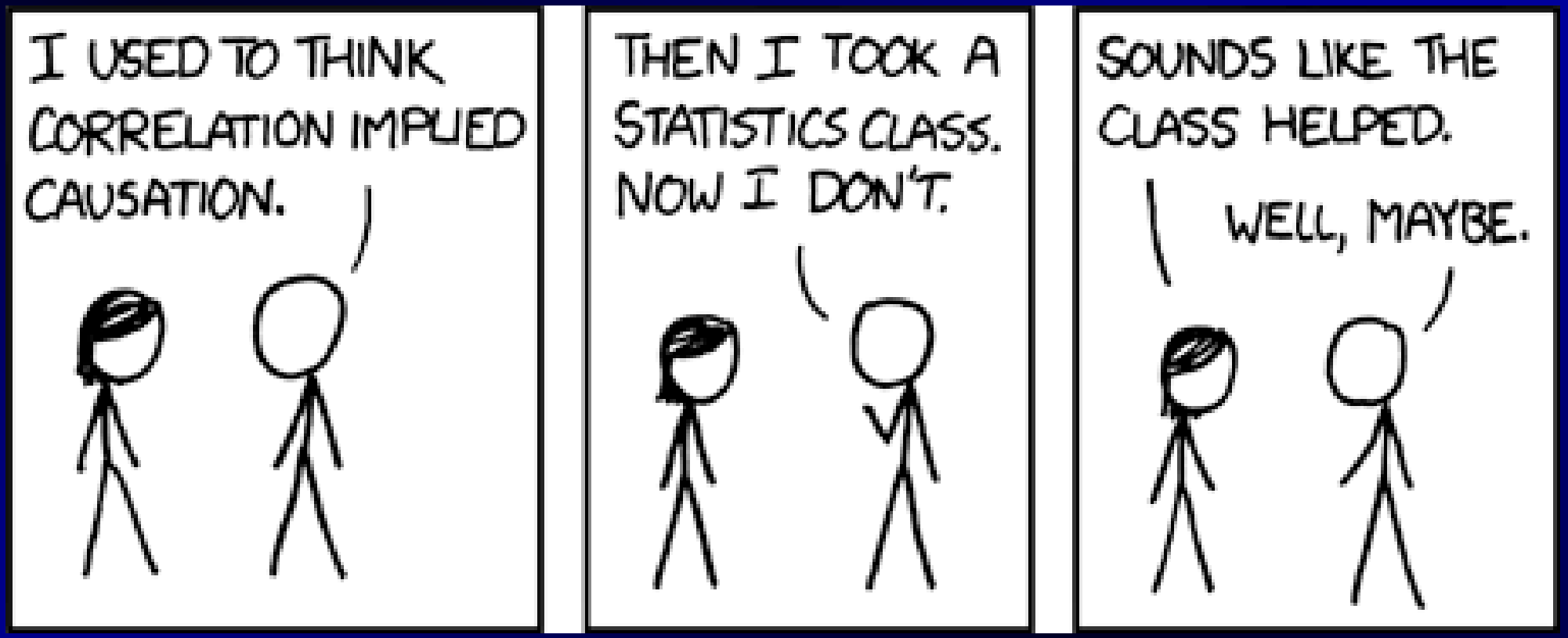
Unpublished Data



Sessler D et al: Anesthesiology 2012;116:1195-203



Sessler D et al: Anesthesiology 2012;116:1195-203

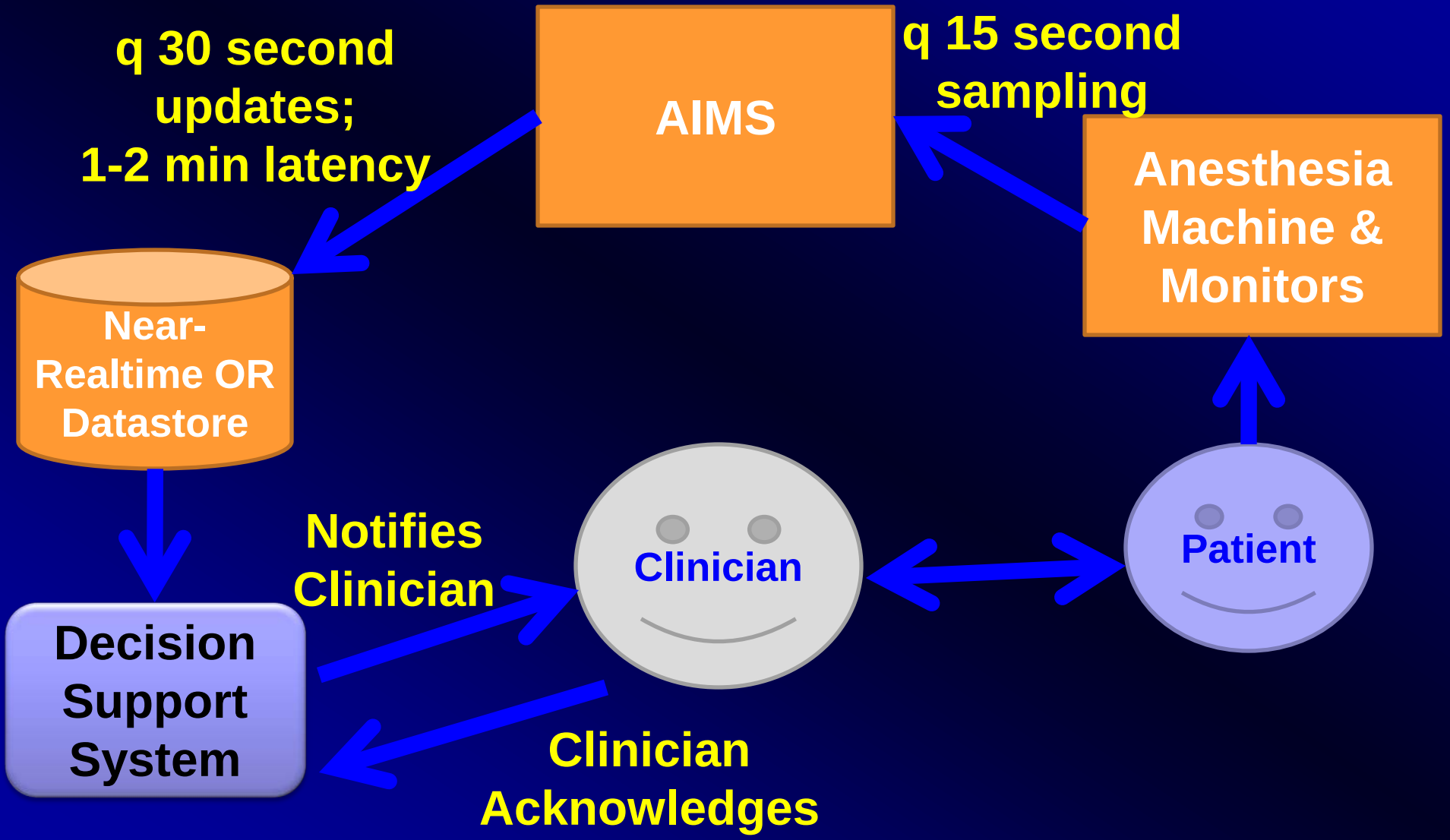


http://xkcd.com/552

Hemodynamics, Anesthetic Depth and Mortality

- Association does not prove causation
- Why should a brief period of hypotension or deep anesthesia be associated with hospital mortality?
  - Acute organ injury?
  - Anesthetic “stress test” is a marker for patients with more severe underlying illness?
    - Cancer patients (debilitated) have exaggerated responses to “standard” anesthetic doses

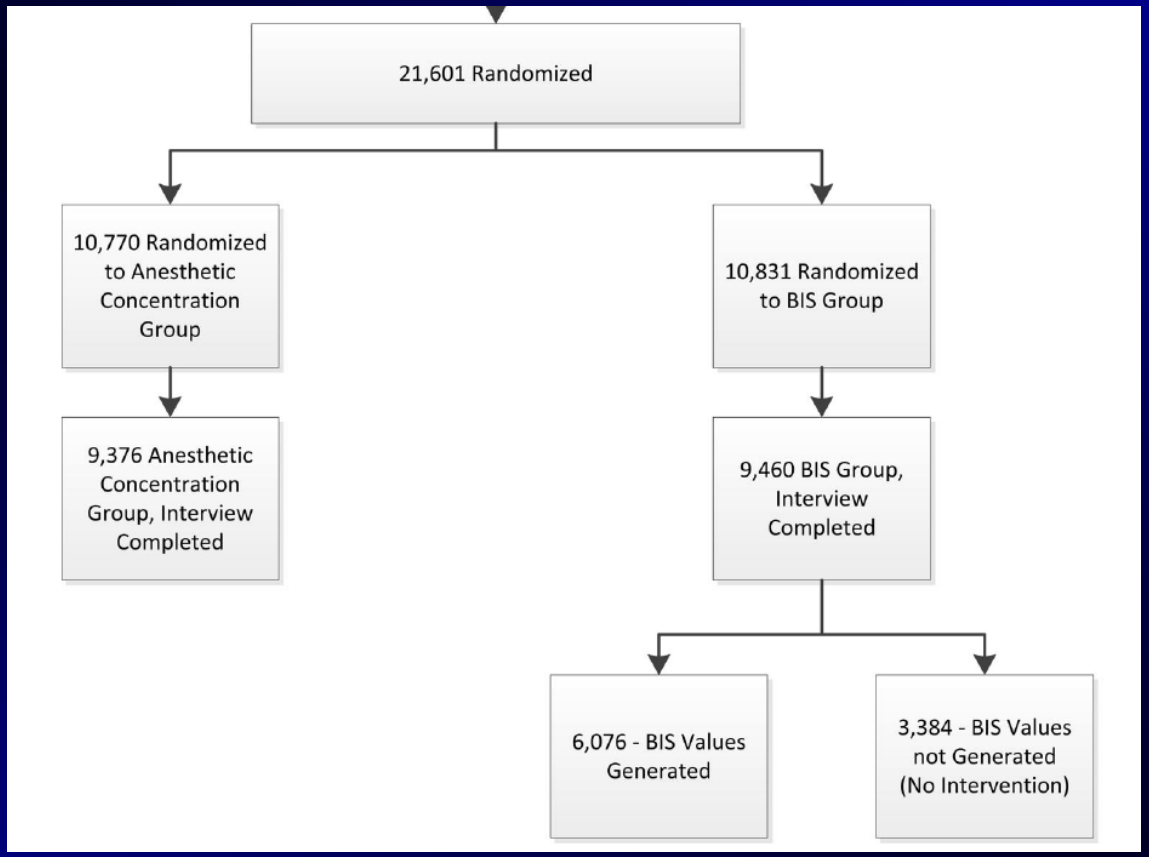
Clinician/DSS Feedback Loop



Prevention of Intraoperative Awareness with Explicit Recall in an Unselected Surgical Population

A Randomized Comparative Effectiveness Trial

George A. Mashour, M.D., Ph.D.,* Amy Shanks, M.S.,†
Kevin K. Tremper, Ph.D., M.D.,‡ Sachin Kheterpal, M.D., M.B.A.,§
Christopher R. Turner, M.D., Ph.D., M.B.A.,‖ Satya Krishna Ramachandran, M.D., F.R.C.A.,§
Paul Picton, M.D., F.R.C.A.,§ Christa Schueller, B.S.,# Michelle Morris, M.S.,**
John C. Vandervest, B.S.,†† Nan Lin, Ph.D.,‡‡ Michael S. Avidan, M.B., B.Ch.§§

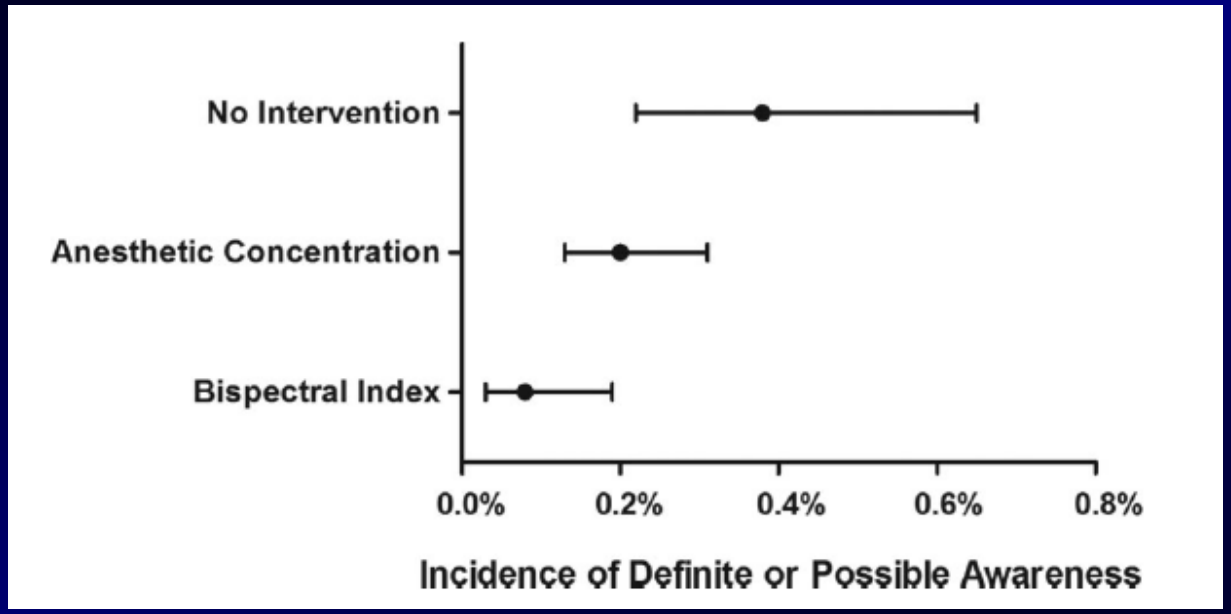


Anesthesiology 2012; 117:717–25

Prevention of Intraoperative Awareness with Explicit Recall in an Unselected Surgical Population

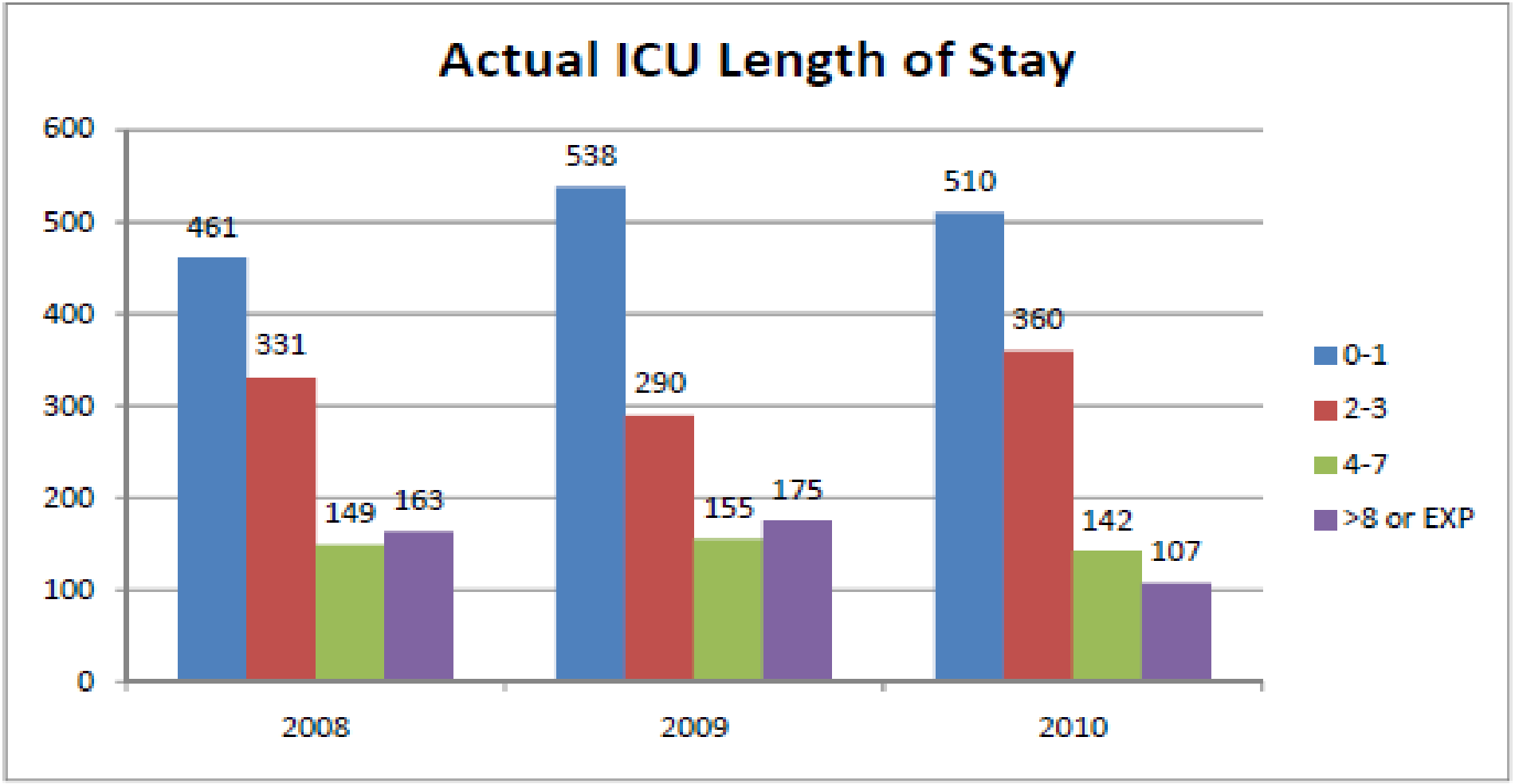
A Randomized Comparative Effectiveness Trial

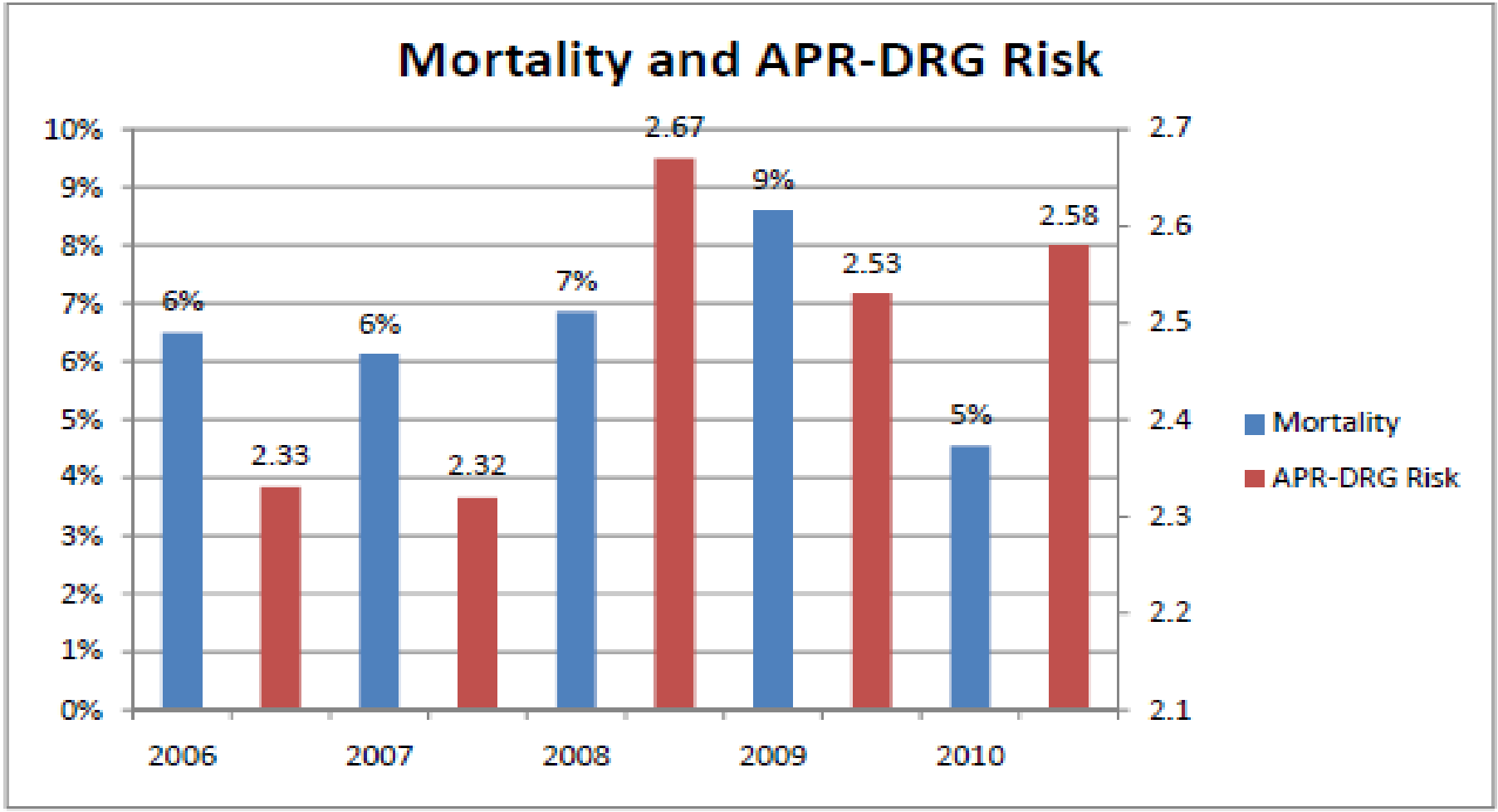
George A. Mashour, M.D., Ph.D.,* Amy Shanks, M.S.,†
Kevin K. Tremper, Ph.D., M.D.,‡ Sachin Kheterpal, M.D., M.B.A.,§
Christopher R. Turner, M.D., Ph.D., M.B.A.,‖ Satya Krishna Ramachandran, M.D., F.R.C.A.,§
Paul Picton, M.D., F.R.C.A.,§ Christa Schueller, B.S.,# Michelle Morris, M.S.,**
John C. Vandervest, B.S.,†† Nan Lin, Ph.D.,‡‡ Michael S. Avidan, M.B., B.Ch.§§

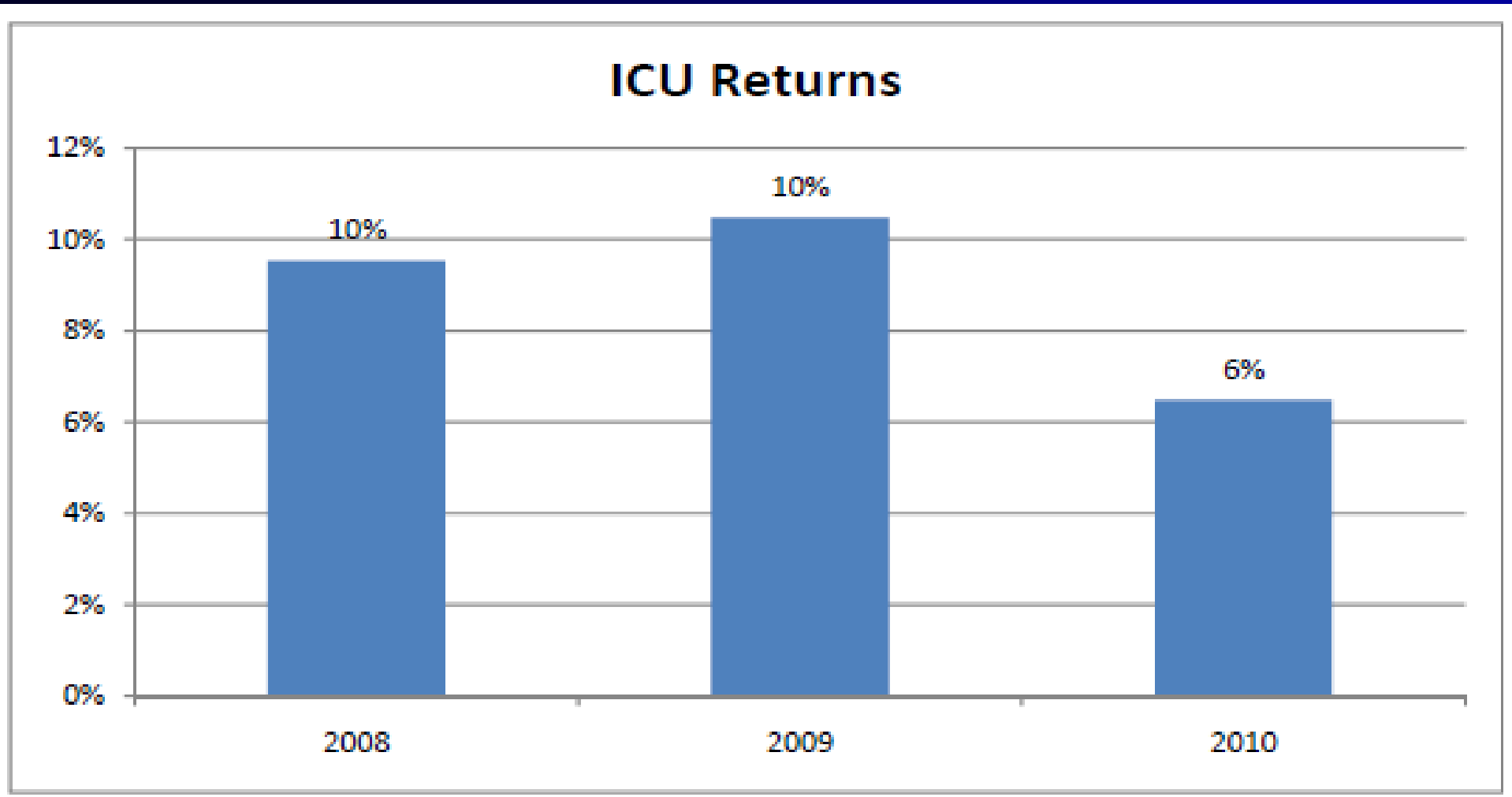


Anesthesiology 2012; 117:717–25

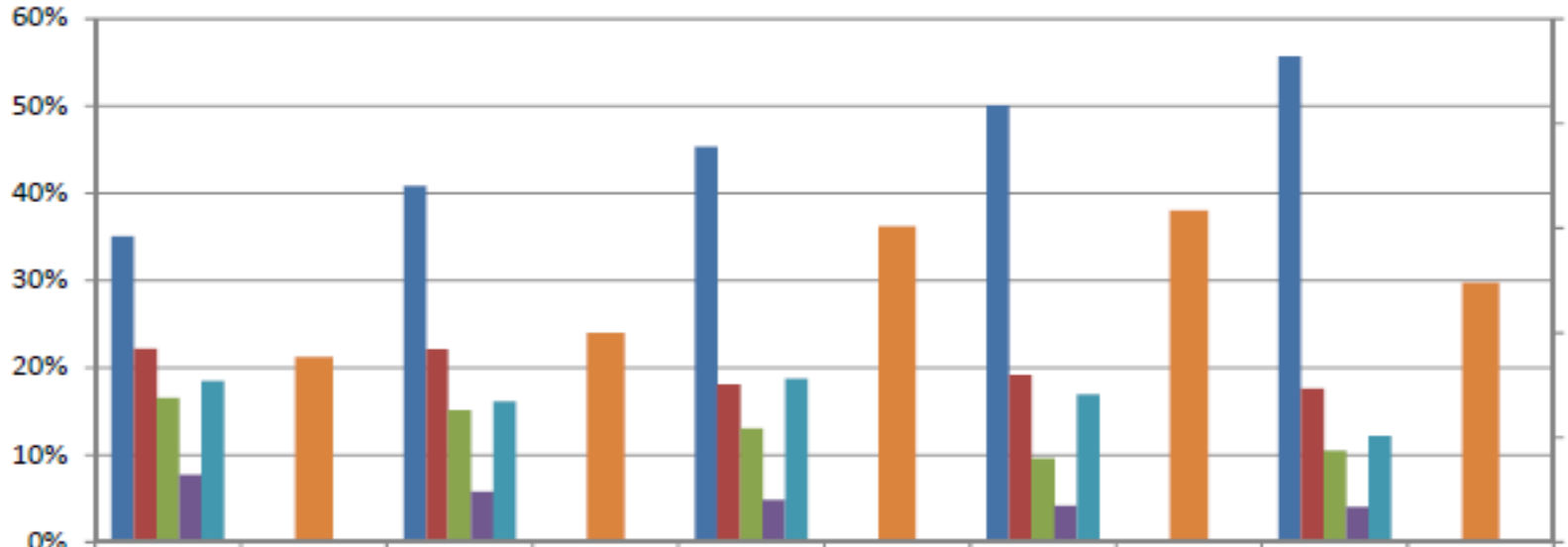
Intensive Care Unit Quality


Actual ICU Length of Stay
600
500
400
300
200
100
0
461
331
149
163
538
290
155
175
510
360
142
107
2008
2009
2010
0-1
2-3
4-7
>8 or EXP


Mortality and APR-DRG Risk
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
2.7
2.6
2.5
2.4
2.3
2.2
2.1
6%
2.33
6%
2.32
7%
2.67
9%
2.53
5%
2.58
2006
2007
2008
2009
2010
Mortality
APR-DRG Risk

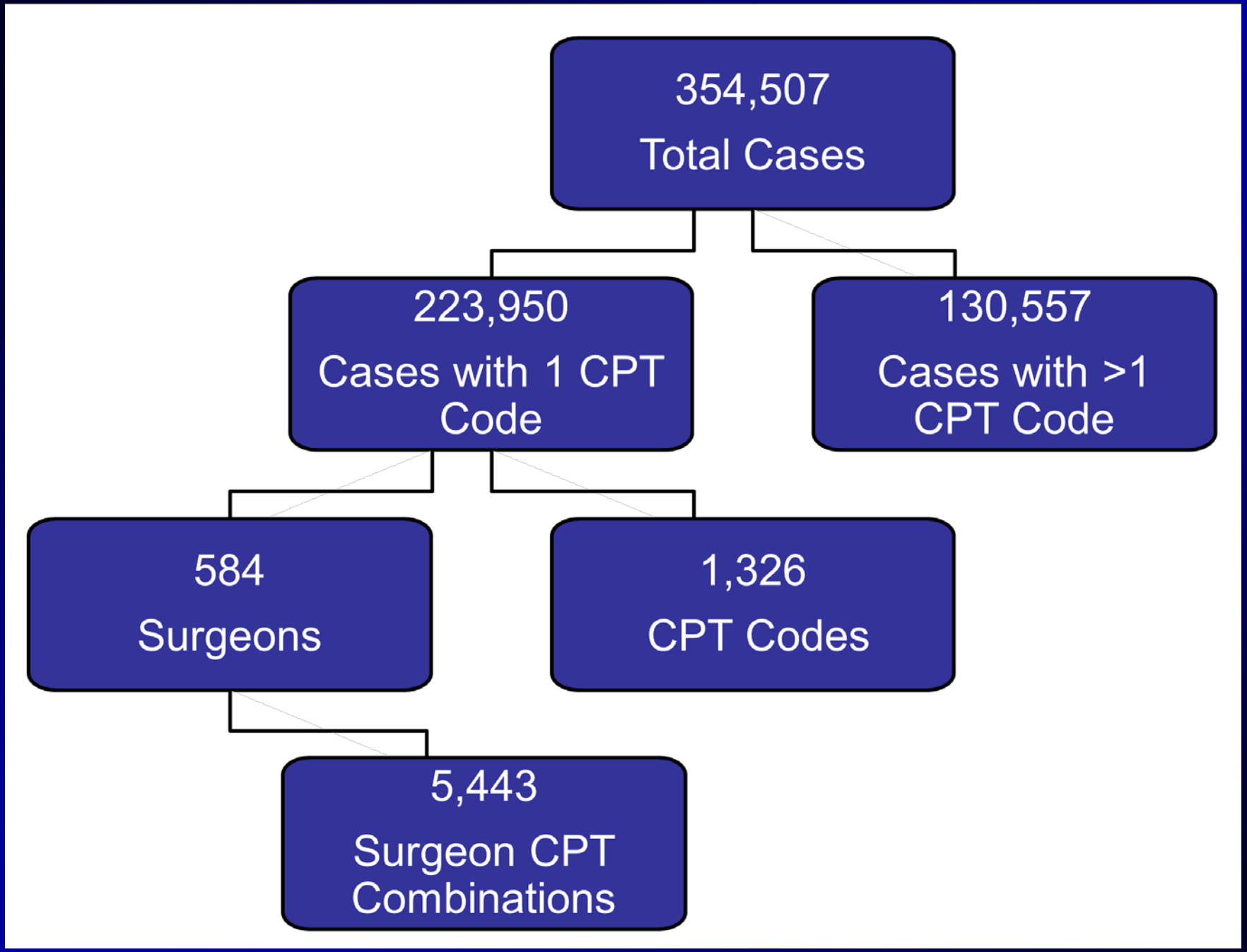

ICU Returns
12%
10%
8%
6%
4%
2%
0%
10%
10%
6%
2008
2009
2010

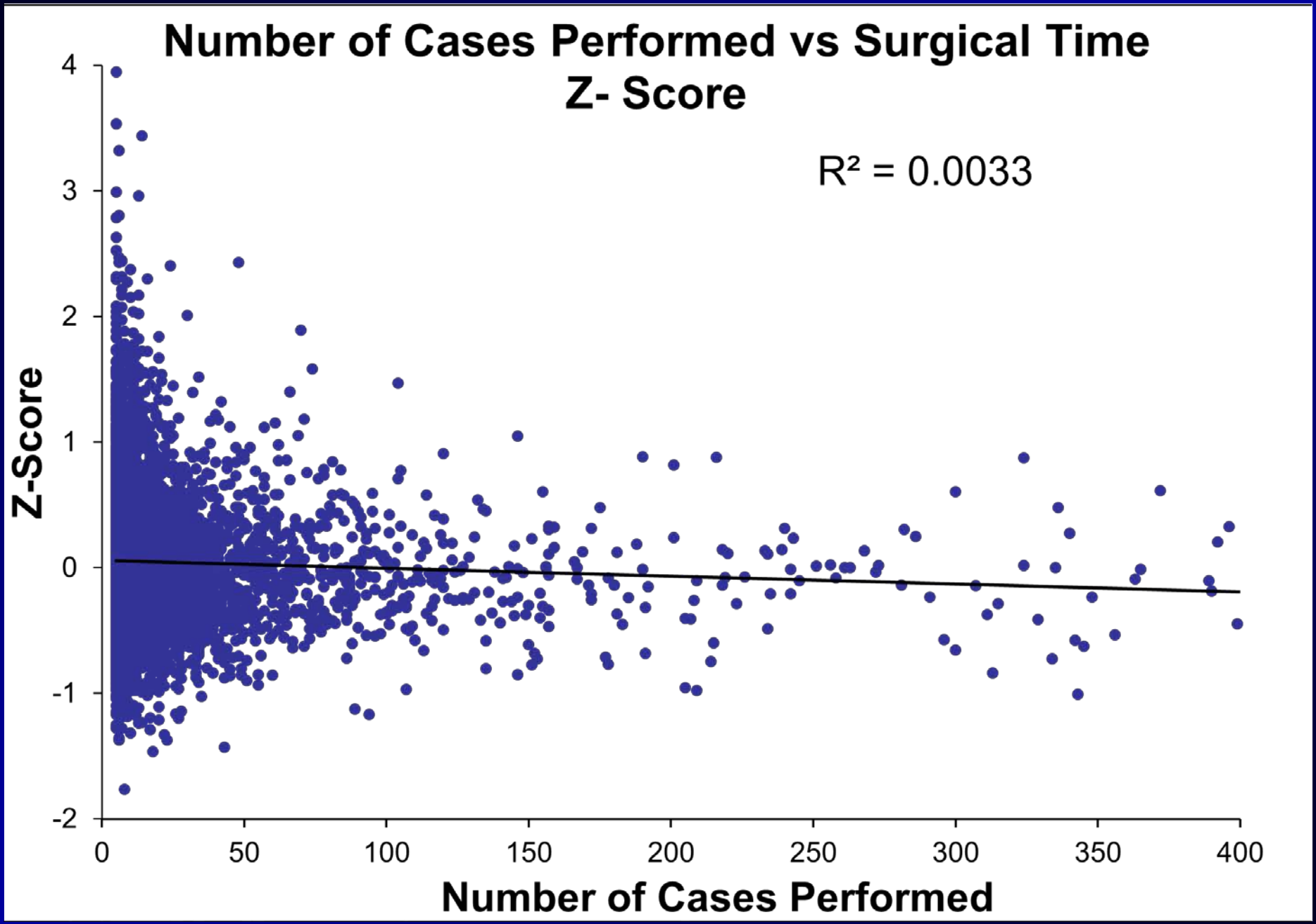
Observed-Expected Hospital LOS

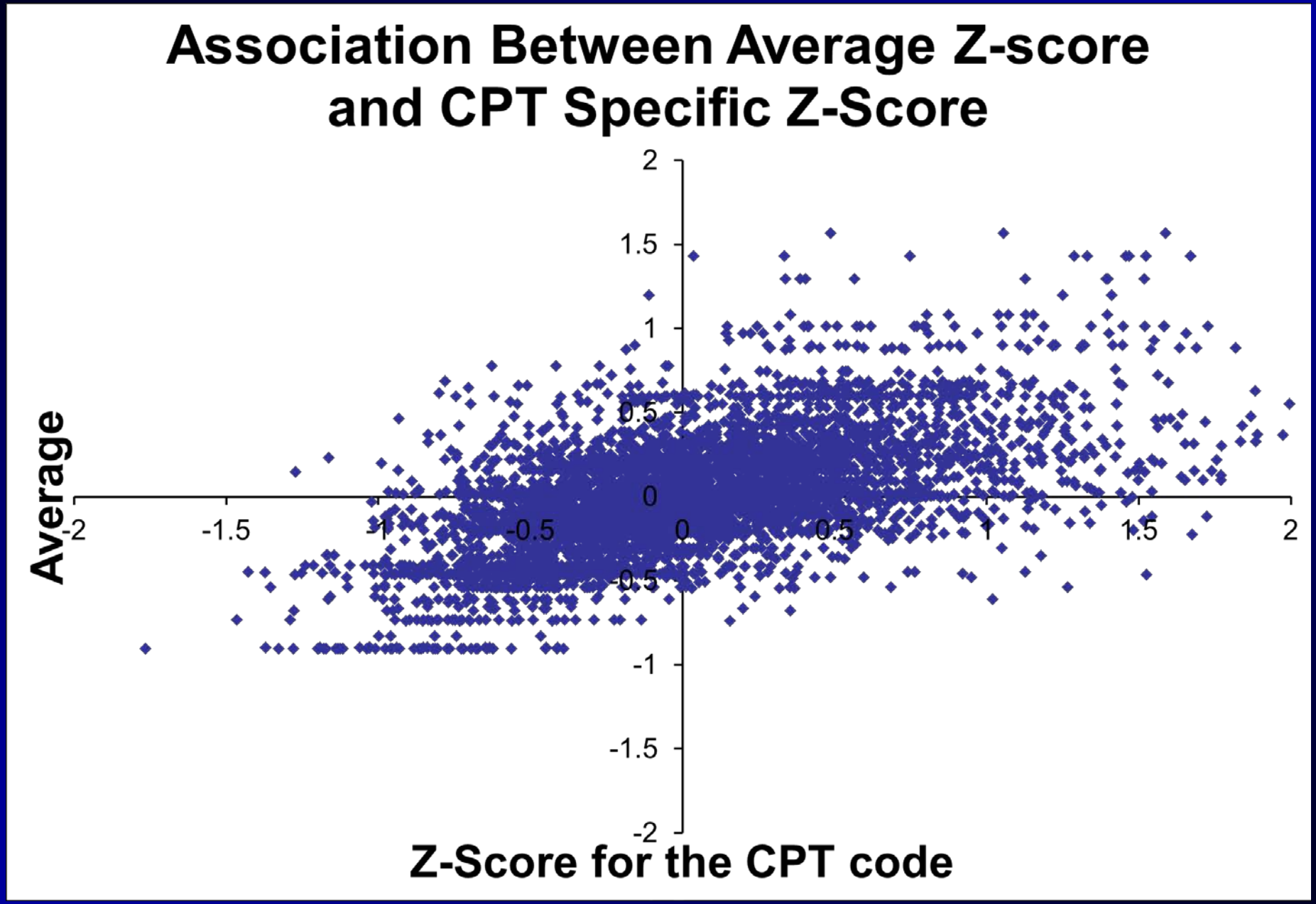


	2006		2007		2008		2009		2010	
<0	35%		41%		45%		50%		56%	
0-1	22%		22%		18%		19%		18%	
2-5	17%		15%		13%		10%		10%	
5-7	8%		6%		5%		4%		4%	
>8 or EXP	19%		16%		19%		17%		12%	
Average ELOS		11.77		12		13.02		13.17		12.48

Surgeon Efficiency


354,507
Total Cases
223,950
Cases with 1 CPT Code
130,557
Cases with >1 CPT Code
584
Surgeons
1,326
CPT Codes
5,443
Surgeon CPT Combinations


Number of Cases Performed vs Surgical Time
Z- Score
R² = 0.0033
Z-Score
4
3
2
1
0
-1
-2
0
50
100
150
200
250
300
350
400
Number of Cases Performed


Association Between Average Z-score and CPT Specific Z-Score
Average
Z-Score for the CPT code
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2

Summary and Discussion

- Report generation needs: OR operations, quality, PQRS, custom reports
- Managing people with data
  - Linking quality with compensation
- Managing all of the missions of the Department