

The Role of Critical Care in Surgical Outcomes

Patrick M Reilly MD FACS

Professor of Surgery



The Trauma Center at Penn

A Regional Resource Facility of the
University of Pennsylvania Health System

Trauma Patient CaseReport

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Surgeon and Intensivist Roles

- Trauma Bay Decision Making
- Operative Procedure
- IR Resuscitation
- ICU Care
 - Resuscitation
 - Surgical Bleeding?
 - Decision to Return to OR



Provider Specific PI

- Narrowing the Focus
- Responsibility
- Consumer Driven
- ACS Supported
 - College Supports Patient Charter for MD Performance Measurement

ACS NewsScope 4/4/2008



Patient Charter

- Measures should be meaningful to consumers
- Those being measured should be actively involved
- Transparent and valid
- National standards



Provider Specific PI

**ADULT
CARDIAC
SURGERY**

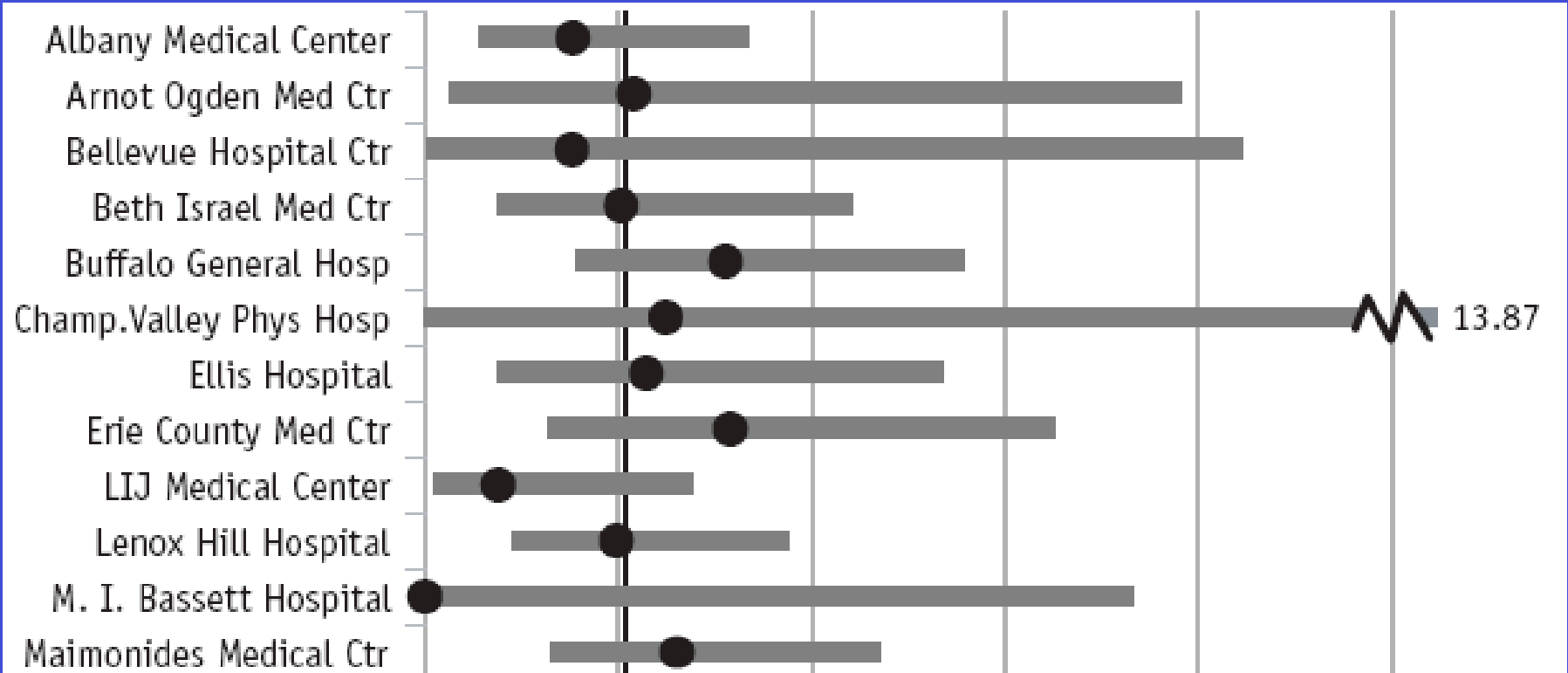
**in
New York State**

2003 – 2005

NY Dept of Health 2008



NSQIP-esque



NY Dept of Health 2008

Provider Specific PI

	Cases	No of Deaths	OMR	EMR	RAMR	95% CI for RAMR
STATEWIDE TOTAL	40429	864	2.14	2.14	2.14	
Albany Medical Center						
Britton L	387	7	1.81	1.64	2.36	(0.94, 4.86)
Devejian N	(. , .)
#Fuzesi L	148	0	0.00	2.29	0.00	(0.00, 2.32)
Miller S	386	8	2.07	1.79	2.47	(1.06, 4.87)
Sardella G	434	5	1.15	1.77	1.39	(0.45, 3.26)
All Others	94	1	1.06	2.14	1.06	(0.01, 5.92)
Total	1449	21	1.45	1.82	1.71	(1.06, 2.61)

NY Dept of Health 2008

NY Cardiac Surgery Data

- Impact Since 1989
 - Progressive Improvement in Outcomes
 - Systems-Based Improvements
 - Cardiac Anesthesia!
 - No Obvious Change in Referral Patterns



Provider Specific Hospital Data

	You	Comparison
Selected Entity	HUP	HUP
Selected Department	SURGERY	SURGERY
Selected Service	TRAUMA SERVICE	TRAUMA SERVICE
Selected Physician	REILLY PATRICK MD (Attending)	

OPPE 2012



OPPE : PMR

	You	Comparison
7 Day Unplanned Readmission All Diagnosis	.67	3.16
30-day All-Cause Overall Re-Admission Rate	3.36	7.35
Observed Mortality Rate	3.70	4.46
Expected Mortality Rate (2010 model)	3.94	4.57
Expected Mortality Rate (2011 model)	2.87	3.80
Observed to Expected Mortality Ratio (2010 model)	.94	.98
Observed to Expected Mortality Ratio (2011 model)	1.29	1.17
SCIP Perfect Care	100.0 %	98.4 %
Length of Stay	7.70	8.11
Case Mix Index (CMI) - DRG Weight	2.4594	2.4398
Foley related UTIs all hospital number	2	25
Surgical Site Infection number	3	20
<u>Communication with Doctors/Domain</u>	79 %	71 %
During this hospital stay, how often did doctors treat you with courtesy and respect?	91 %	80 %
n =	11	194
During this hospital stay, how often did doctors listen carefully to you?	73 %	71 %
n =	11	195
During this hospital stay, how often did doctors explain things in a way you could understand?	73 %	63 %
n =	11	193
<u>Overall Rating of Hospital/Domain</u>		
Using any number from 0 to 10, where 0 is the worst hospital possible and 10 is the best hospital possible, what number would you use to rate this hospital during your stay?	55 %	69 %
n =	11	194
Recommend this hospital	64 %	72 %
n =	11	191

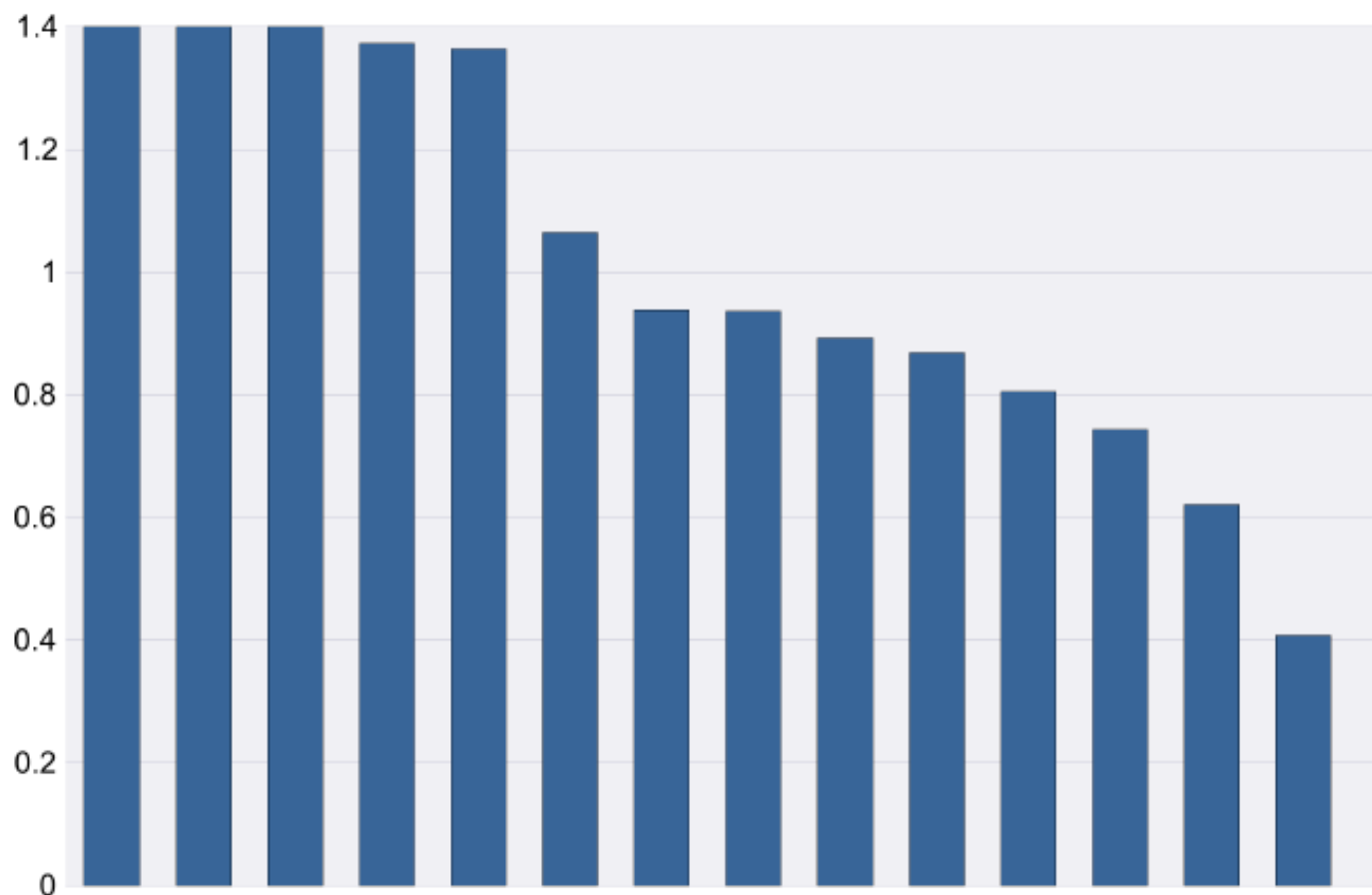


OPPE : Trauma

Observed to Expected Mortality Ratio Comparison

Selected Entity: HUP
Selected Service: TRAUMA SERVICE
Selected Physician: ALL

Comparison Entity: HUP
Comparison Service: TRAUMA SERVI



Critical Care Outcomes

Physician Staffing Patterns and Clinical Outcomes in Critically Ill Patients A Systematic Review

Peter J. Pronovost, MD, PhD

Derek C. Angus, MB, ChB, MPH

Todd Dorman, MD

Karen A. Robinson, MSc

Tony T. Dremsizov, MBA

Tammy L. Young

JAMA 2002

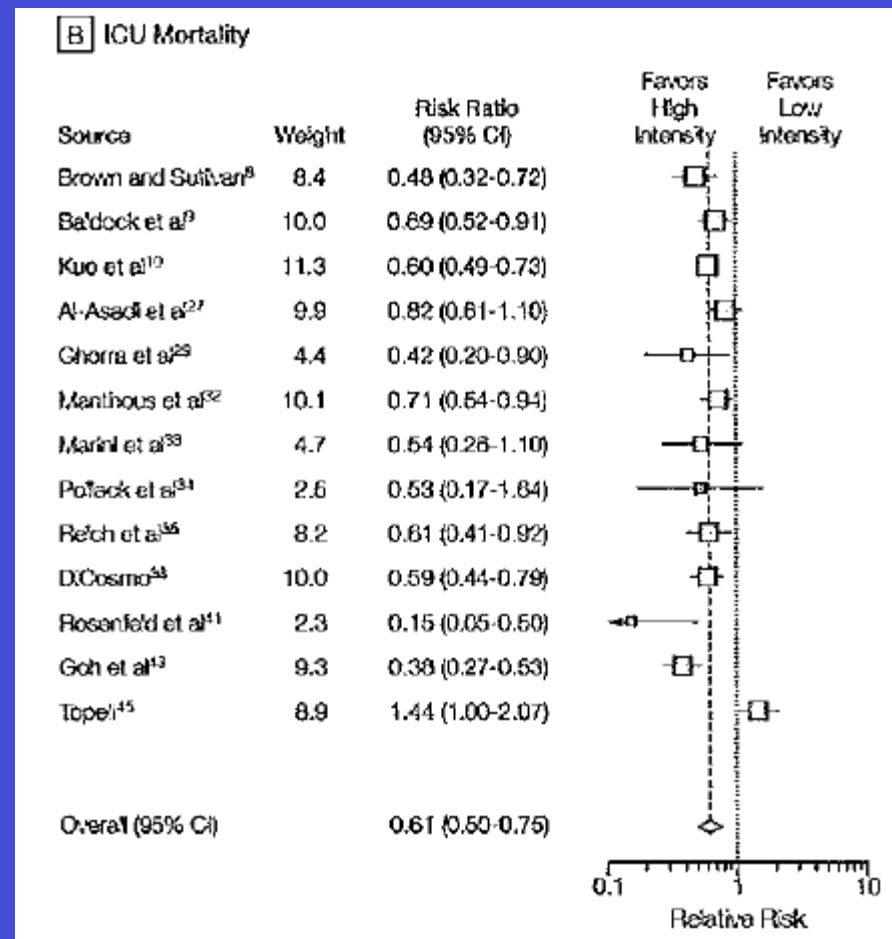


Physician Staffing Patterns and Clinical Outcomes in Critically Ill Patients

A Systematic Review

- Hospital Mortality
Similar Benefit

JAMA 2002

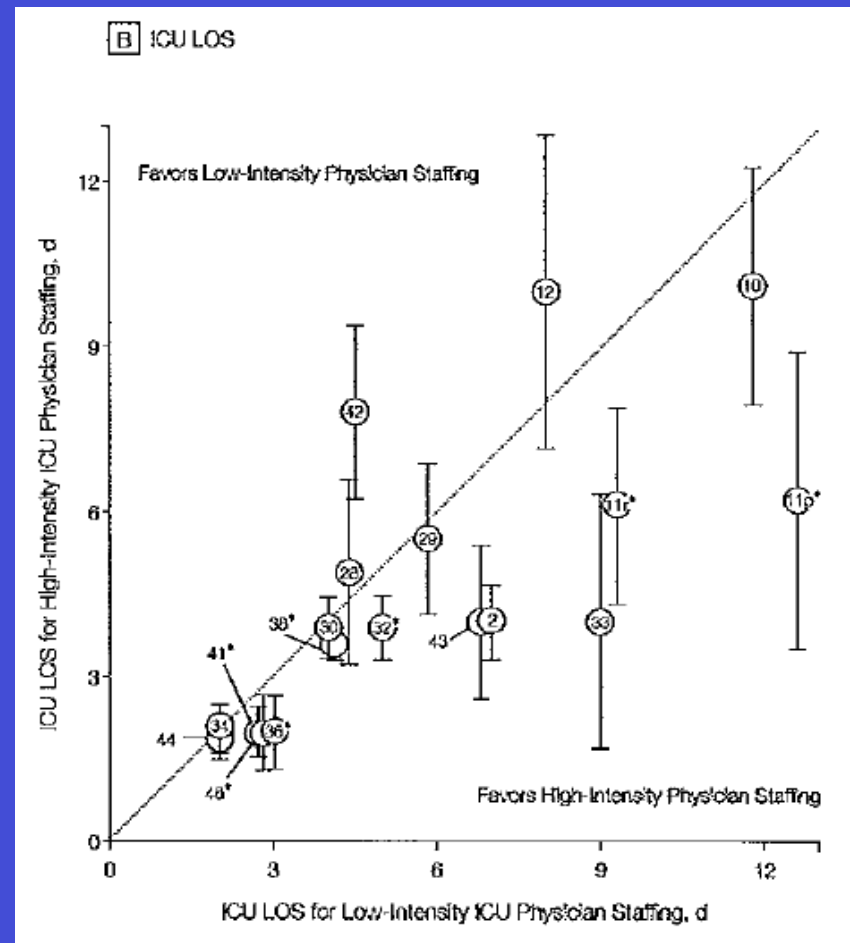


Physician Staffing Patterns and Clinical Outcomes in Critically Ill Patients

A Systematic Review

- Similar Benefit Hospital LOS

JAMA 2002



AAA Outcomes

Organizational Characteristics of Intensive Care Units Related to Outcomes of Abdominal Aortic Surgery

Peter J. Pronovost, MD

Mollie W. Jenckes, MHSc

Todd Dorman, MD

Elizabeth Garrett, BS

Michael J. Breslow, MD

Brian A. Rosenfeld, MD

Pamela A. Lipsett, MD

Eric Bass, MD, MPH

JAMA 1999



Organizational Characteristics of Intensive Care Units Related to Outcomes of Abdominal Aortic Surgery

Table 3. Risk of Postoperative Complications With No Daily Rounds by an ICU Physician for Abdominal Aortic Surgery Patients in Maryland, 1994-1996*

Complications	Patients With Complication, % (n = 2606)	OR (95% CI) of Without vs With Daily Rounds of ICU Physician
Medical complications		
Pulmonary insufficiency after procedure	11.8	1.9 (0.5-7.8)
Cardiac complications after procedure	10.8	1.4 (0.7-2.4)
Acute renal failure	4.7	2.2 (1.3-3.9)†
Septicemia	3.4	1.8 (1.2-2.6)†
Acute myocardial infarction	2.6	1.4 (0.7-2.8)
Cardiac arrest	1.2	2.9 (1.2-7.0)†
Surgical complications		
Surgical complications after procedure‡	8.6	1.5 (0.8-2.0)
Surgical E codes§	0.3	4.3 (0.9-20.0)
Interventions		
Reintubation	14.1	2.0 (1.1-4.1)†
Reoperation for bleeding	2.4	1.1 (0.5-2.6)
Platelet transfusion	2.0	6.4 (3.2-12.4)†

Organizational Characteristics of Intensive Care Units Related to Outcomes of Abdominal Aortic Surgery

Table 4. Relationship of Patient and ICU Characteristics to In-Hospital Mortality, Hospital Length of Stay, and ICU Days for Abdominal Aortic Surgery Patients in Maryland, 1994-1996*

	In-Hospital Mortality, Adjusted OR (95% CI)	Estimated Increase in Hospital Length of Stay, Adjusted % (95% CI)	Estimated Increase in ICU Days, Adjusted % (95% CI)
ICU characteristics#			
Physician characteristics			
No daily rounds by an ICU physician	3.0 (1.9 to 4.9)‡	...	83 (48 to 126)‡
<50% of ICU attendings certified in critical care	1.2 (0.8 to 1.7)

JAMA 1999



Esophagectomy Outcomes

Intensive care unit physician staffing is associated with decreased length of stay, hospital cost, and complications after esophageal resection

Justin B. Dimick, MD; Peter J. Pronovost, MD, PhD; Richard F. Heitmiller, MD; Pamela A. Lipsett, MD

Crit Care Med 2001



Intensive care unit physician staffing is associated with decreased length of stay, hospital cost, and complications after esophageal resection

Complication	Without Daily Rounds by ICU Physician, % (n = 169)	With Daily Rounds by ICU Physician, % (n = 182)	Odds Ratio (95% CI)	p Value
Pulmonary insufficiency	10	3	4.0 (1.4–11.0)	.008
Pneumonia	14	8	2.0 (1.0–4.0)	.053
Aspiration	27	18	1.7 (1.0–2.8)	.043
Reintubation	24	10	2.8 (1.5–5.2)	.001
Cardiac arrest	1	0	— ^a	— ^a
Myocardial infarction	1	1	2.2 (0.2–24.2)	.53
Cardiac complications	15	15	1.0 (0.5–1.7)	.88
Septicemia	5	2	2.2 (0.7–7.5)	.65
Postoperative infection	5	4	1.2 (0.4–3.5)	.68
Acute renal failure	7	1	6.3 (1.4–28.7)	.018
Surgical complications ^b	15	5	3.3 (1.5–7.4)	.003

Crit Care Med 2001

Non-Trauma Outcomes

Maintaining quality of care 24/7 in a nontrauma surgical intensive care unit

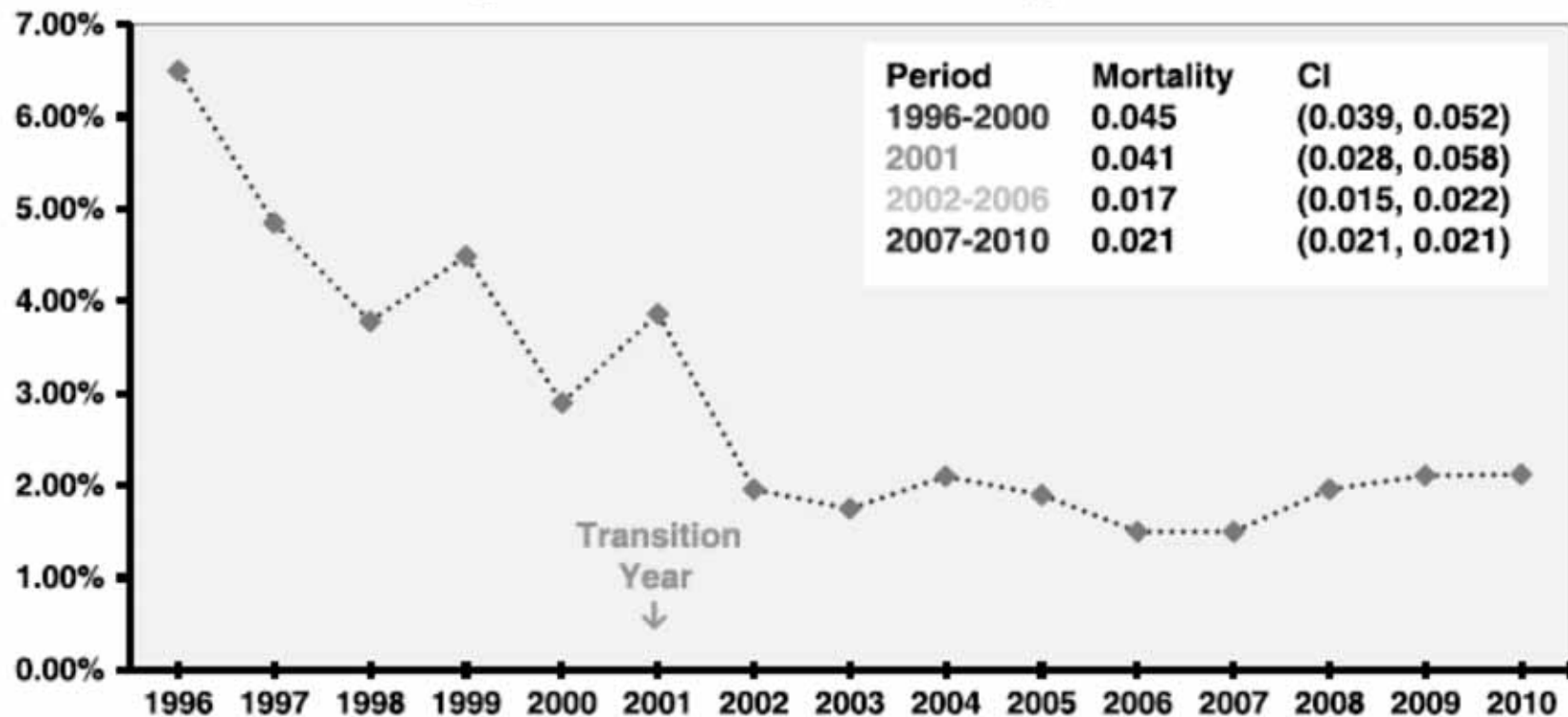
Marvin Allan McMillen, MD, Nathan Boucher, PA-C, David Keith, PA-C, David Scott Gould, PA-C, Asaf Gave, MD, and Darryl Hoffman, MB, BS, New York, New York

J Trauma 2012



Maintaining quality of care 24/7 in a nontrauma surgical intensive care unit

Surgical ICU Service Mortality, 1996-2010



Improving Outcomes

ORIGINAL ARTICLE

Outcomes of Adult Trauma Patients Admitted to Trauma Centers in Pennsylvania, 2000-2009

Laurent G. Glance, MD; Turner M. Osler, MD; Dana B. Mukamel, PhD; Andrew W. Dick, PhD

Arch Surg 2012



Outcomes of Adult Trauma Patients Admitted to Trauma Centers in Pennsylvania, 2000-2009

Laurent G. Glance, MD; Turner M. Osler, MD; Dana B. Mukamel, PhD; Andrew W. Dick, PhD

- Ten Year Review
- PTOS database
- Risk Adjusted Mortality
 - Trauma Mortality Prediction Model
- In Hospital Mortality



Mortality Trend - ISS

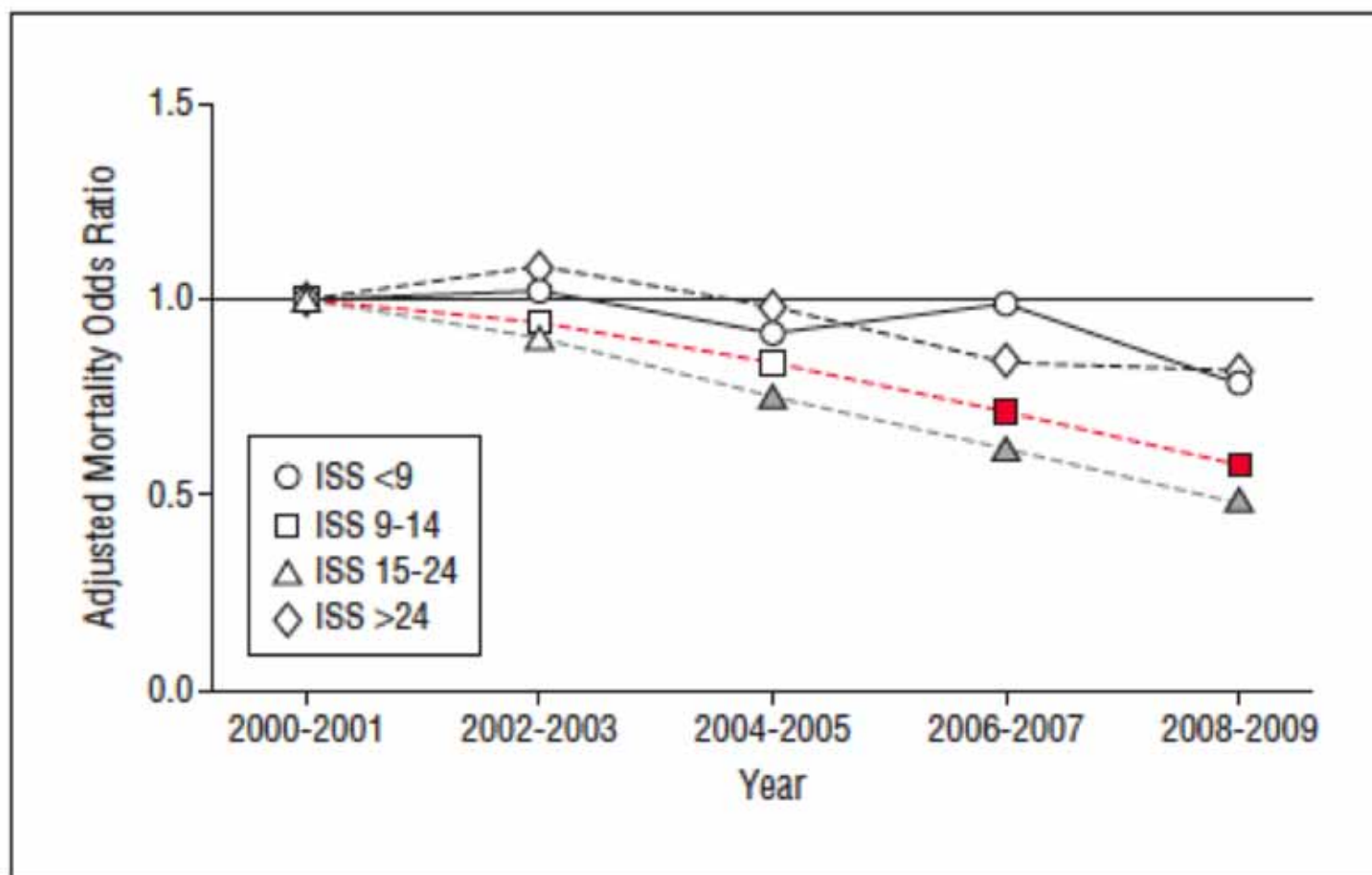


Figure 1. Trends in mortality rate as a function of injury severity. ISS indicates Injury Severity Score; solid symbols, $P < .05$.

Mortality Trend - Shock

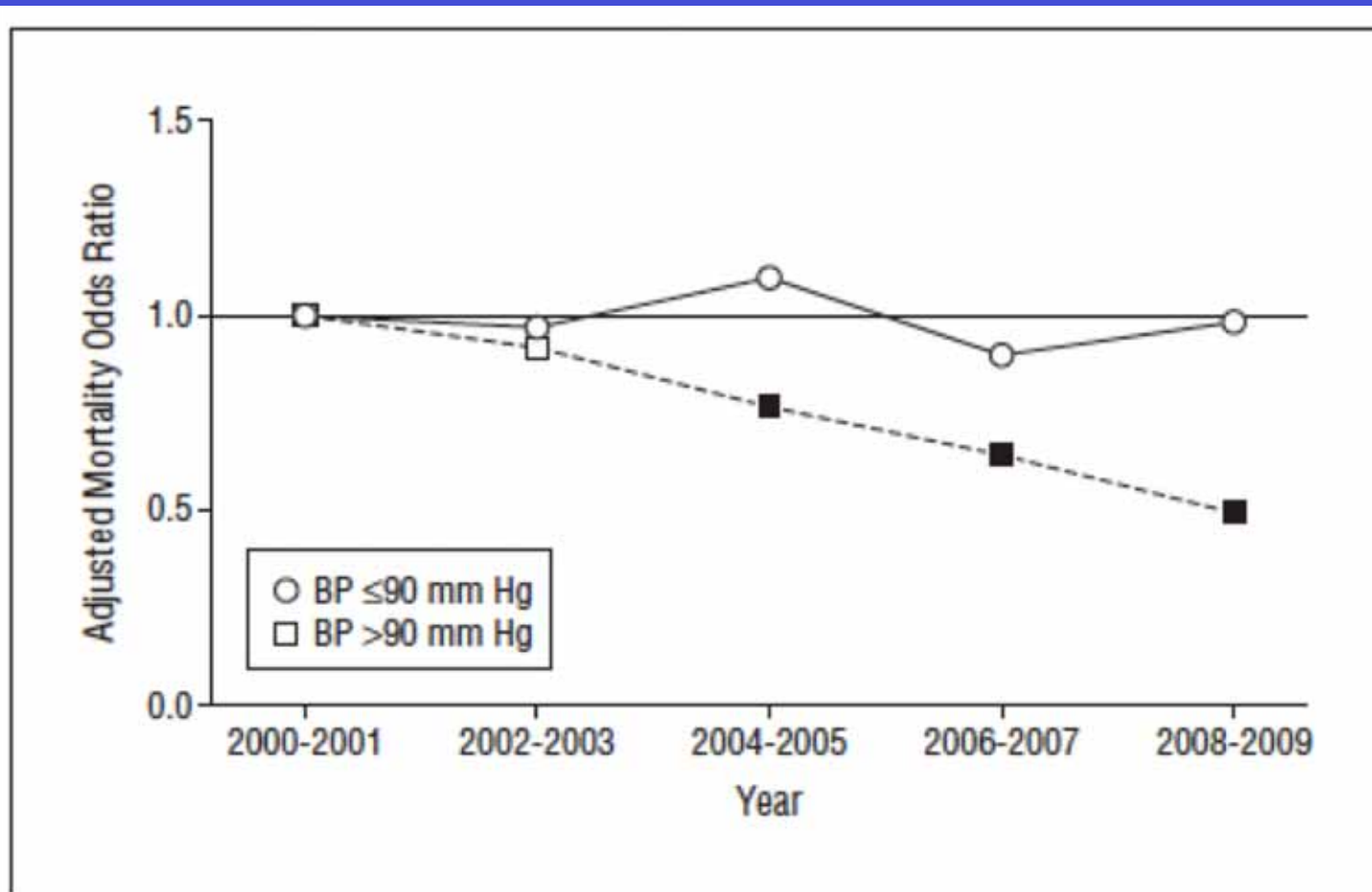


Figure 2. Trends in mortality rate as a function of hypotension for patients with an Injury Severity Score between 9 and 24. BP indicates blood pressure; solid symbols, $P < .05$.

Mortality Trend - Mechanism

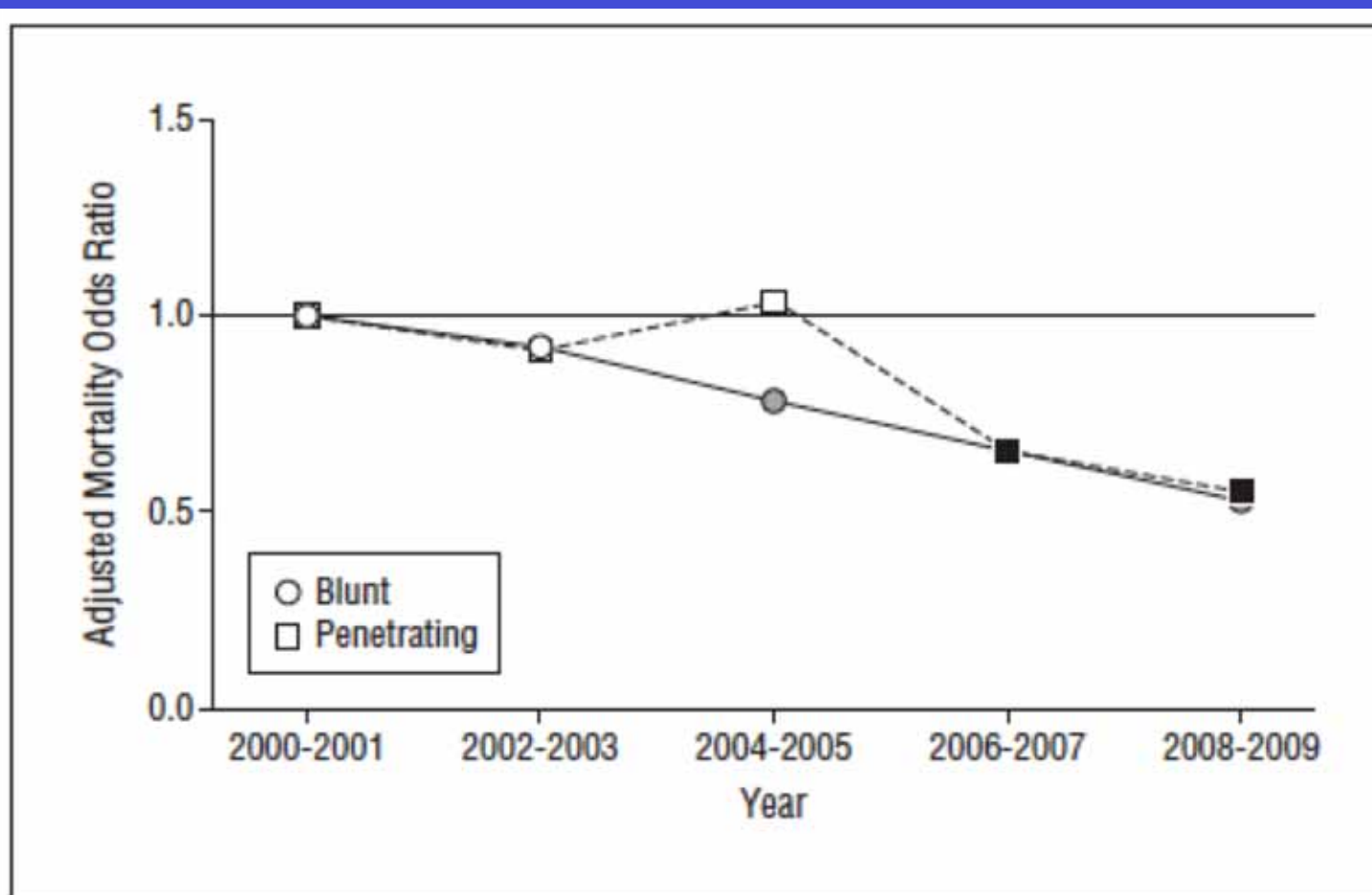


Figure 3. Trends in mortality rate as a function of mechanism of injury for patients with an Injury Severity Score between 9 and 24. Solid symbols indicate $P < .05$.

Outcomes of Adult Trauma Patients Admitted to Trauma Centers in Pennsylvania, 2000-2009

Laurent G. Glance, MD; Turner M. Osler, MD; Dana B. Mukamel, PhD; Andrew W. Dick, PhD

- 30% Mortality Risk Decrease
- 40% Decrease
 - Moderate and Severe Injury
- Little Change
 - Minor and Very Severe
- Little Change
 - Shock



Outcomes of Adult Trauma Patients Admitted to Trauma Centers in Pennsylvania, 2000-2009

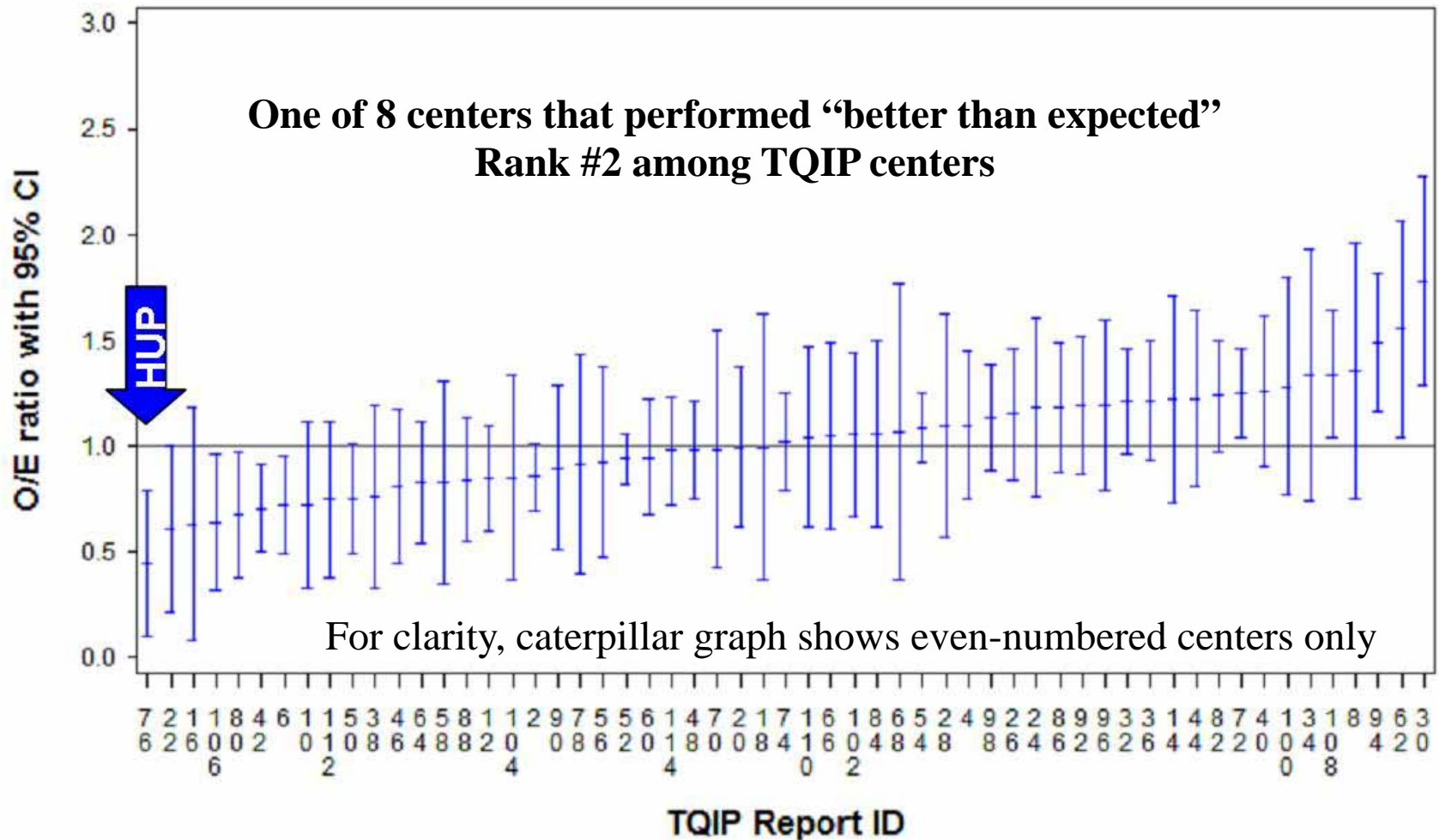
Laurent G. Glance, MD; Turner M. Osler, MD; Dana B. Mukamel, PhD; Andrew W. Dick, PhD

- Mechanisms – Unclear
 - ICU Care
 - Damage Control
 - Early Enteral Feeds
 - Other?



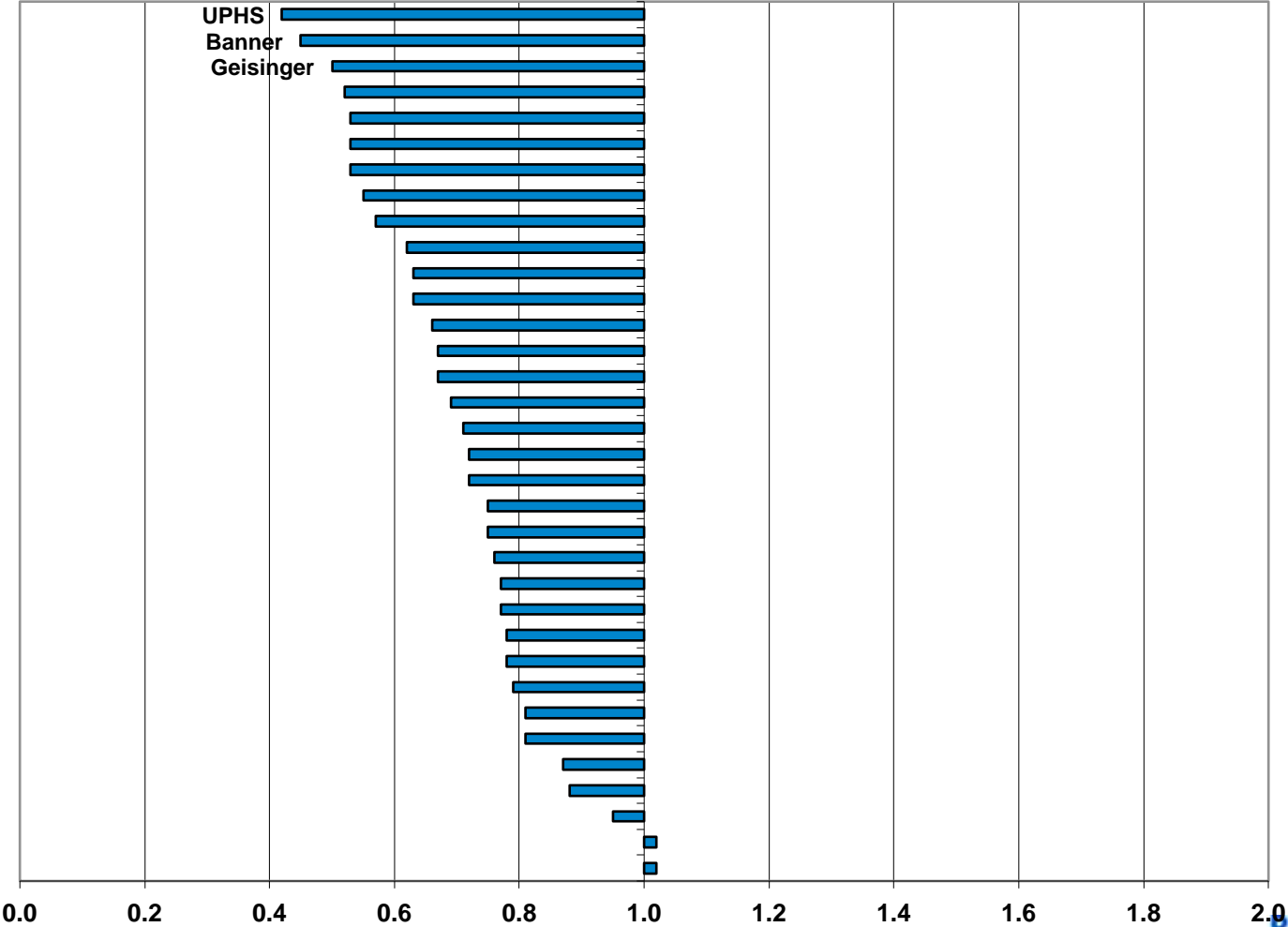
HUP Trauma Mortality

Risk Adjusted Mortality: Blunt Multisystem Injuries
Including those classified as DOA or died in the ED



Mortality Benchmark

Hospital Mortality Ratio - Q3 2011



Failure to Rescue

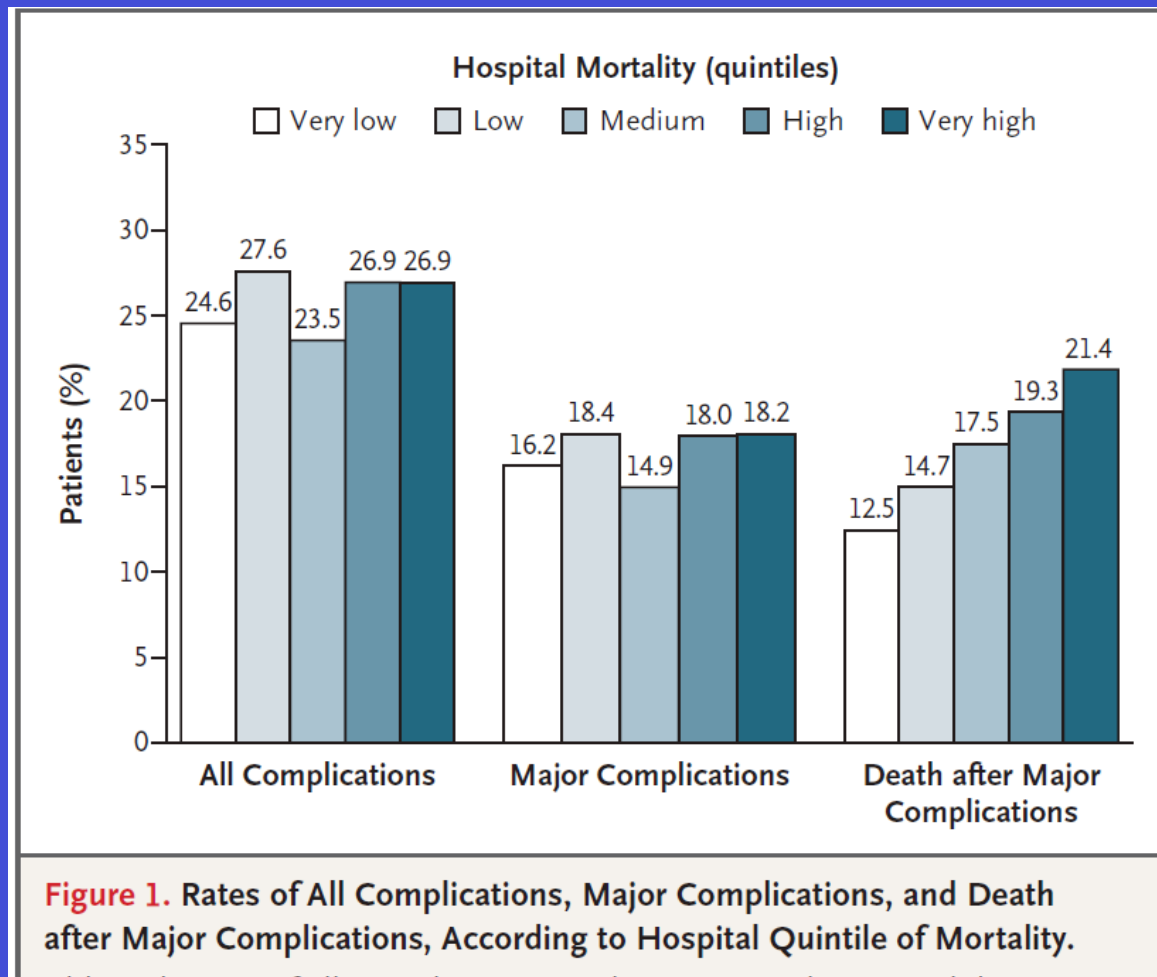
Variation in Hospital Mortality Associated with Inpatient Surgery

Amir A. Ghaferi, M.D., John D. Birkmeyer, M.D.,
and Justin B. Dimick, M.D., M.P.H.

NEJM 2009



Variation in Hospital Mortality Associated with Inpatient Surgery



NEJM 2009



Failure to Rescue

Prevention of Complications and Successful Rescue of Patients With Serious Complications: Characteristics of High-Performing Trauma Centers

*Barbara Haas, MD, David Gomez, MD, Mark R. Hemmila, MD, FACS,
and Avery B. Nathens, MD, PhD, FACS*

J Trauma 2011

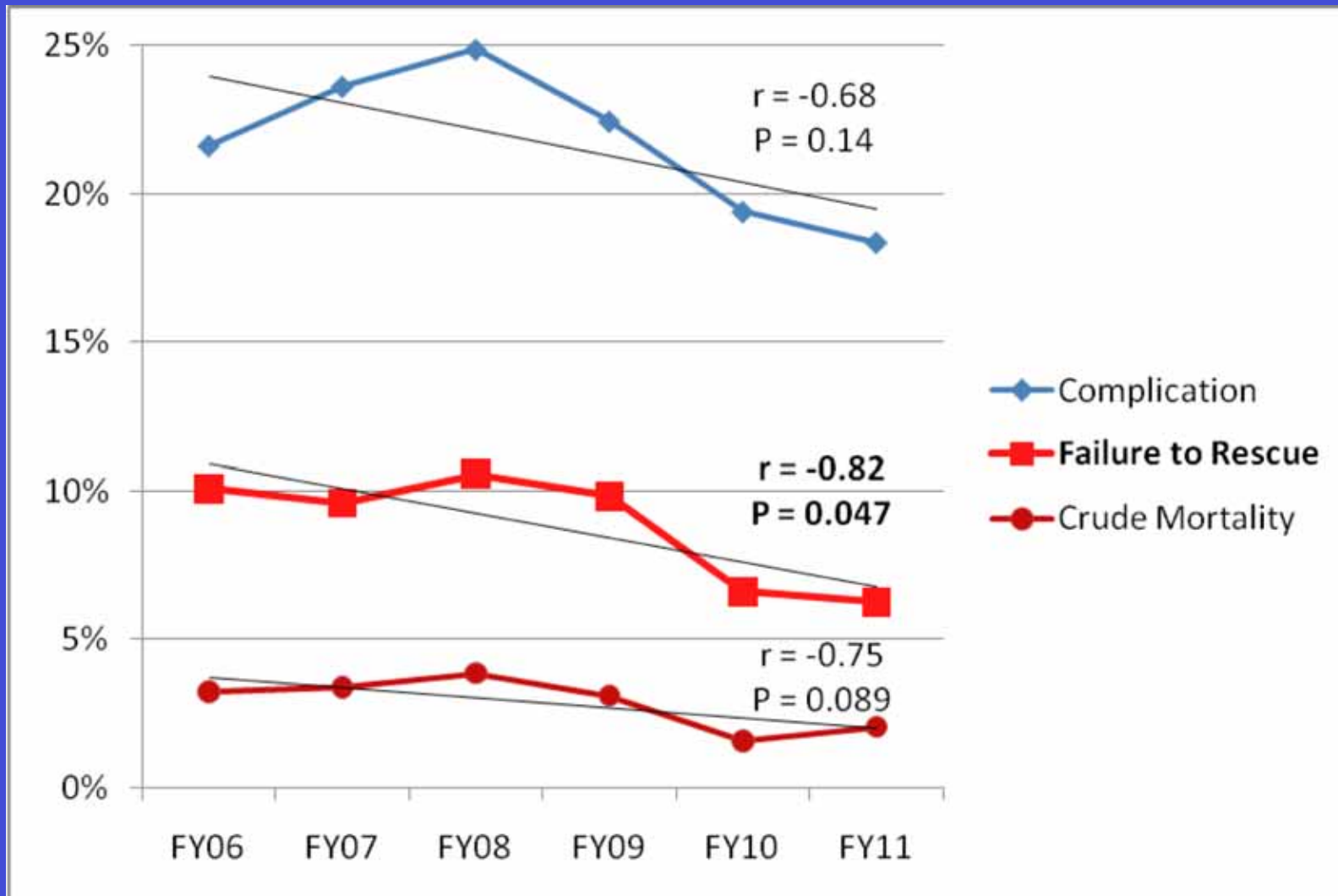


Prevention of Complications and Successful Rescue of Patients With Serious Complications: Characteristics of High-Performing Trauma Centers

TABLE 3. Trauma Center Outcomes by Quintile of Mortality

	Quintile of Center Performance			
	Lowest Mortality	2	3	4
Number of centers	23	23	23	23
Mean predicted mortality (%)	7.1	7.8	7.6	8.2
Mean risk-adjusted mortality (%)	5.5	6.9	7.8	8.8
Mean risk-adjusted complication rate (%)	7.7	8.3	9.7	10.6
Patients who experienced a complication				
Mean predicted mortality (%)	17.7	16.2	16.4	16.5
Mean risk-adjusted mortality (%)	11.1	11.8	15.8	18.3

Failure to Rescue



AAST 2011

Trauma Outcomes

The Impact of an Intensivist-Model ICU on Trauma-Related Mortality

Avery B. Nathens, MD, MPH, PhD, Frederick P. Rivara, MD, MPH,* Ellen J. MacKenzie, PhD,†
Ronald V. Maier, MD,* Jin Wang, PhD,* Brian Egleston, PhD,‡ Daniel O. Scharfstein, ScD,‡
and Gregory J. Jurkovich, MD**

Annals Surg 2006



The Impact of an Intensivist-Model ICU on Trauma-Related Mortality

- Multicenter
- Prospective
- Cohort Study
- Open vs Intensivist-Led ICU
 - Separate ICU Service
 - Co-Managed by Intensivist

Annals Surg 2006



The Impact of an Intensivist-Model ICU on Trauma-Related Mortality

TABLE 4. Adjusted Relative Risk of Death in Intensivist-Model ICUs*

	Relative Risk (95% CI)	<i>P</i> (Interaction Term)[†]
All patients	0.78 (0.58–1.04)	NA
Director is board certified in surgery and critical care		<0.01
Yes	0.67 (0.50–0.90)	
No	1.61 (0.95–2.72)	

Annals Surg 2006

Trauma Outcomes

The Delivery of Critical Care Services in US Trauma Centers: Is the Standard Being Met?

*Avery B. Nathens, MD, PhD, MPH, Ronald V. Maier, MD, Gregory J. Jurkovich, MD, Daphne Monary,
Frederick P. Rivara, MD, MPH, and Ellen J. Mackenzie, PhD*

J Trauma 2006



The Delivery of Critical Care Services in US Trauma Centers: Is the Standard Being Met?

- Questionnaire
- Level I and Level II Centers
- Intensivist Model
 - Director Board Certified
 - > 50% Physicians Board Certified
 - Intensivist Daily Rounds
 - Authority to Write Orders



The Delivery of Critical Care Services in US Trauma Centers: Is the Standard Being Met?

Table 5 Critical Care Staffing

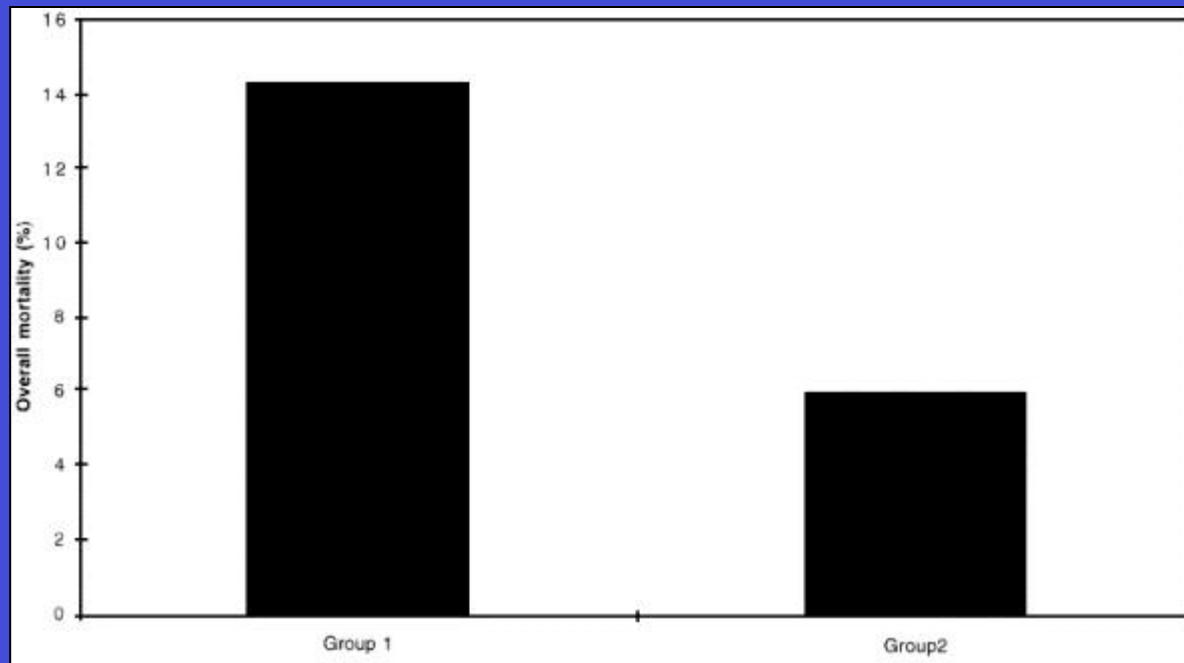
	Level I	Level II	All	p Value
Dedicated critical care provider without responsibilities outside of ICU	32 (24)	15 (10)	47 (16)	0.002
Residents have no responsibilities outside of ICU (for programs with residents)	80 (61)	17 (35)	97 (54)	0.003
Number of physicians providing critical care services				<0.001
1-4	55 (41)	36 (24)	91 (32)	
5-9	68 (51)	65 (43)	133 (47)	
>10	10 (8)	48 (32)	58 (21)	
Participation of surgeons* in the delivery of critical care services	130 (98)	146 (97)	272 (98)	0.5
Providers board certified in critical care (%)				<0.001
100	75 (57)	25 (17)	100 (35)	
75-99	29 (22)	15 (10)	44 (16)	
50-74	9 (7)	22 (15)	31 (11)	
<50	18 (14)	88 (59)	106 (38)	
Dedicated ICU coverage at night	85 (63)	29 (19)	114 (40)	<0.001
No in-house coverage at night	10 (7)	51 (34)	61 (21)	<0.001
Nurse patient ratio <1:2 anytime	4 (3)	19 (13)	23 (8)	0.003

- 61% Level I Intensivist Model
- 22% Level II Intensivist Model

J Trauma 2006



ICU Structure Open vs Closed



Annals of Surgery 1999



ICU Structure Open vs Closed

Morbidity Variable	Odds Ratio	P < z
Group (I or II patients)	0.4994	0.012
Sex	0.8481	0.556
Age	0.9939	0.564
APACHE III	1.0415	0.0001
Prerenal	1.5834	0.403

Annals of Surgery 1999



ICU Structure

Semi- Closed

Category	CCS	NCCS	<i>p</i> Value
Age (yr)	61.33 ± 1.5	59.4 ± 1.3	NS
Gender (female/male)	44:56	40:60	—
ICU admission APACHE II score	13.9 ± 0.5	11.8 ± 0.4	<.01
ICU length of stay (days)	2.0 ± 0.3	2.8 ± 0.4	<.05
Complications/ICU stay	0.5 ± 0.1	1.7 ± 0.3	<.01
Equipment-days	6.5 ± 0.9	9.9 ± 0.4	NS
Arterial blood gases (n)	3.0 ± 0.4	6.1 ± 1.0	<.01
Blood products (units)	1.2 ± 0.3	2.0 ± 0.5	NS
Days of ventilation	0.7 ± 0.3	1.2 ± 0.3	<.01
Number of consultations	1.6 ± 0.1	2.8 ± 0.2	<.01
Hospital length of stay (days)	20.3 ± 2.0	23.6 ± 2.3	<.05
Medicare-adjusted charges ^a	34.5 ± 3	47.5 ± 5	<.01
Deaths during hospitalization	4	6	NS

CCS, critical care service; NCCS, no critical care service; APACHE, Acute Physiology and Chronic Health Evaluation score; ICU, intensive care unit.

^aValues are in thousands of US dollars.

Crit Care Med 1999

ICU Structure Semi-Closed

Transition to a Semiclosed Surgical Intensive Care Unit (SICU) Leads to Improved Resident Job Satisfaction: A Prospective, Longitudinal Analysis

Meredith S. Tinti, MD, Elliott R. Haut, MD,† Annamarie D. Horan, PhD,‡ Seema Sonnad, PhD,§
Patrick M. Reilly, MD,‡ C. William Schwab, MD,‡ and Vicente H. Gracias, MD‡*

J Surg Ed 2009



ICU Structure

Semi-Closed

Transition to a Semiclosed Surgical Intensive Care Unit (SICU) Leads to Improved Resident

Improved nurse job satisfaction and job retention with the transition from a “mandatory consultation” model to a “semiclosed” surgical intensive care unit: A 1-year prospective evaluation*

Elliott R. Haut, MD; Corinna P. Sicoutris, CRNP; Denise M. Meredith, CRNP; Seema S. Sonnad, PhD; Patrick M. Reilly, MD; C. William Schwab, MD; C. William Hanson, MD; Vicente H. Gracias, MD



Crit Care Med 2006

Critical Care Workforce

Report to Congress

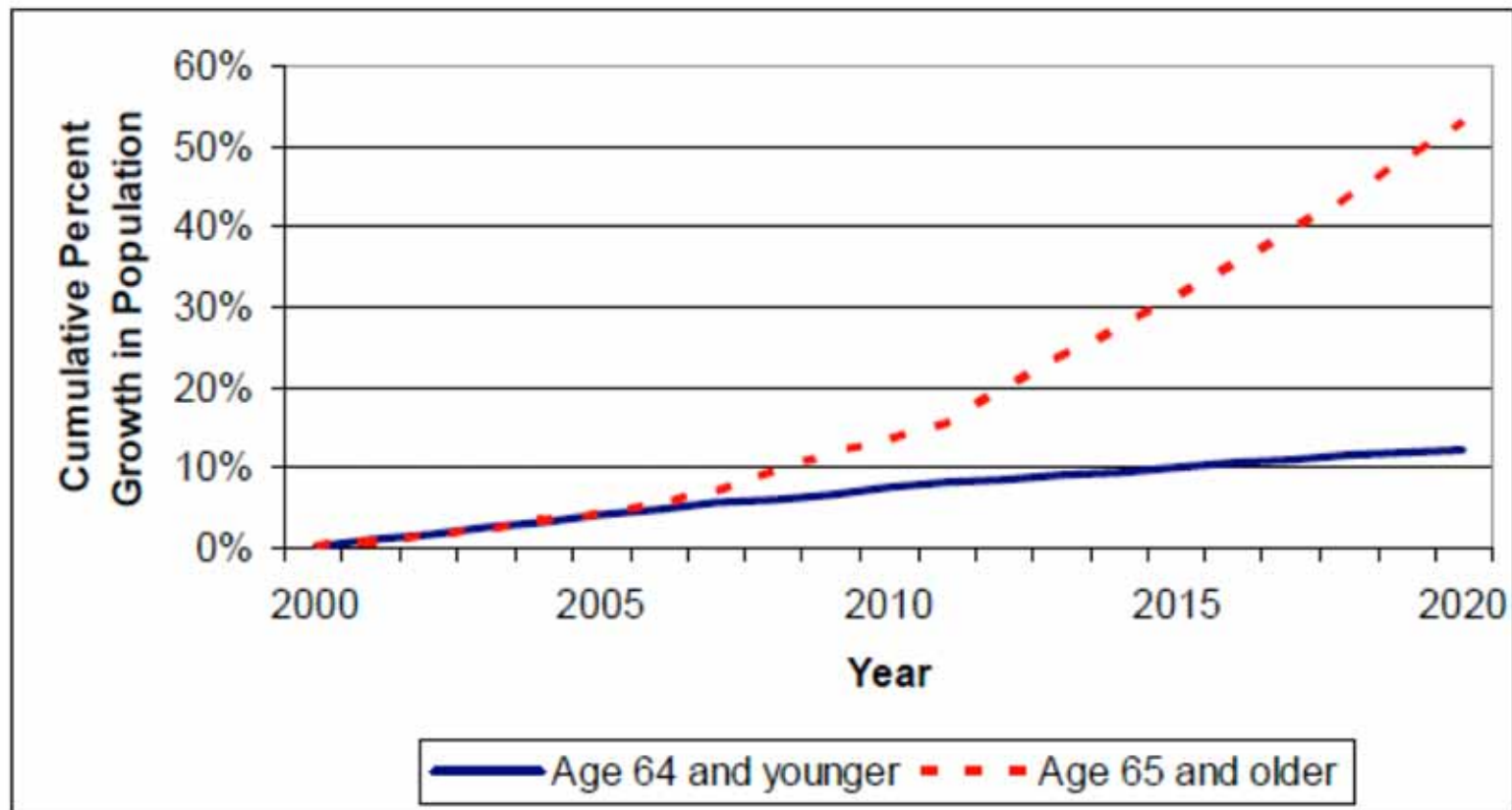
The Critical Care Workforce: A Study of the Supply and Demand for Critical Care Physicians

HRSA 2006



Critical Care Workforce

Exhibit 12. U.S. Population Growth: 2000 to 2020

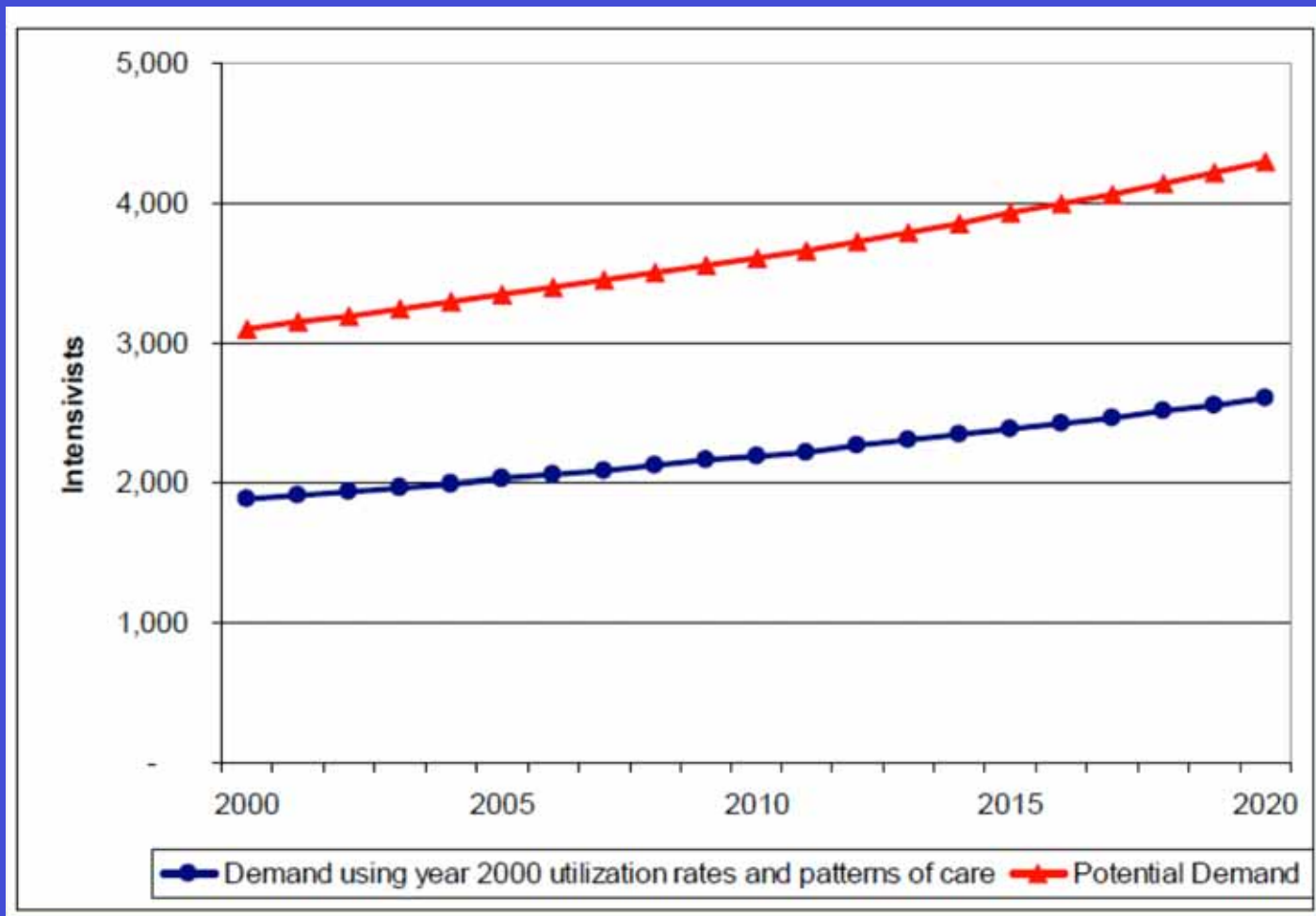


Critical Care Workforce

Exhibit 13. Intensivist Utilization by Age Group, 2000

Age Category	Critical Care Physicians /100,000 Pop.
18 to 24	0.13
25 to 44	0.30
44 to 64	1.48
64 to 74	4.94
75 to 84	7.66
84+	9.44

Critical Care Workforce



HRSA 2006

Future Issues

Providing Care for Critically Ill Surgical Patients

Challenges and Recommendations

*Samuel A. Tisherman, MD; Lewis Kaplan, MD; Vicente H. Gracias, MD; Gregory J. Beilman, MD;
Christine Toevs, MD; Matthew C. Byrnes, MD; Craig M. Coopersmith, MD;
for the Surgery Section, Society of Critical Care Medicine*

JAMA Surg 2013



Future Issues

Providing Care for Critically Ill Surgical Patients

Challenges and Recommendations

S
C
f Training and Certification in Surgical Critical Care: A Position
Paper by the Surgical Critical Care Program Directors Society

*Hasan B. Alam, MD, Jeffrey G. Chipman, MD, Fred A. Luchette, MD, MS, Marc J. Shapiro, MD,
David A. Spain, MD, and William Cioffi, MD; on behalf of the Surgical Critical Care Program Directors Society*

J Trauma 2010



Future Issues

Providing Care for Critically Ill Surgical Patients

Challenges and Recommendations

S Training and Certification in Surgical Critical Care: A Position
C
f Paper by the Surgical Critical Care Program Directors Society

L The role and value of surgical critical care,
an essential component of Acute Care Surgery, in
the Affordable Care Act: A report from
the Critical Care Committee and Board of
Managers of the American Association for the
Surgery of Trauma *y*

Future Issues

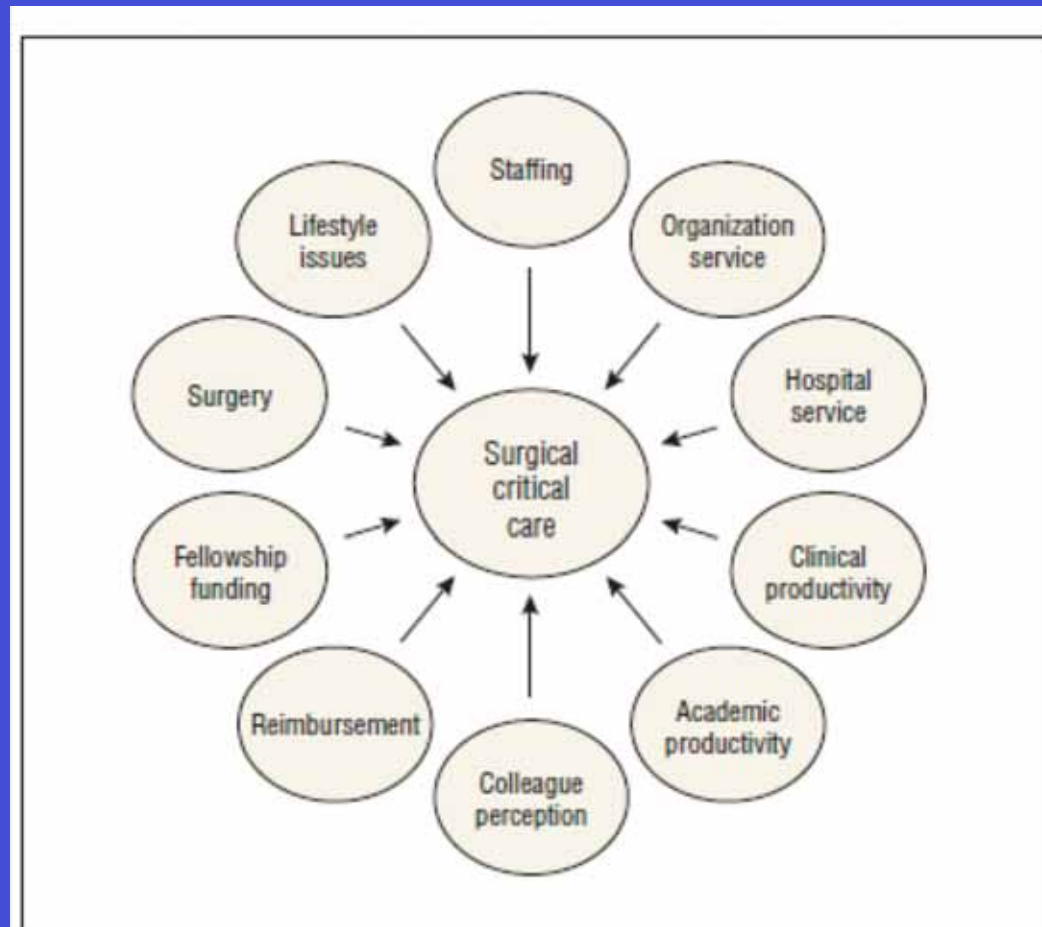


Figure. Factors that may influence the ability to provide the intensivist model of care in surgical intensive care units.

Summary - Surgeon

- Provider Specific Outcomes
 - Outcomes Improving
 - Critical Care a Driver in Improvement
- Surgeon in the ICU
 - Stay Involved
 - Team Dynamics Improved
 - Less Conflict
- Future Issues Will Continue



Summary - Intensivist

- Intensivist
 - Associated with Better Outcomes
 - Team Dynamics Improved
 - Job Security
 - Financial Aspects
 - Work with Primary Surgeon
 - Less Conflict
- Future Issues Will Continue



Thank You

