

# Innovative Strategies in Optimizing Flow

International Symposium on EDIS  
November 2010, Miami, FL

Brent R. Asplin MD, MPH  
Chair, Department of Emergency Medicine  
Mayo Clinic College of Medicine  
Rochester, MN  
E-mail: [Asplin.Brent@Mayo.edu](mailto:Asplin.Brent@Mayo.edu)

FUTURE OF EMERGENCY CARE

# HOSPITAL-BASED EMERGENCY CARE AT THE BREAKING POINT



AMERICAN COLLEGE OF  
EMERGENCY PHYSICIANS

# Key Findings

- Between 1993 and 2003:
  - ED visits grew 26% to 114 million annually
  - The number of EDs decreased by 400
  - The number of operating hospital beds decreased by nearly 200,000

# Goals

- Consequences of delays in patient flow
- Hospital-wide flow strategies
- New ED flow models
- Key requirements for IT infrastructure development
- The big picture: improving value in healthcare

# Ending Boarding

- Why?
- What outcomes do people care about?
  - Mortality
  - Morbidity
  - Money

# Crowding & Mortality

- Chalfin et al. Crit Care Med 2007; 35:1477–1483
  - Impact of delayed transfer of critically ill patients from the emergency department to the intensive care unit
  - Project IMPACT database
  - 90 US hospitals, 120 ICUs, 200,000 patients, 2000-2003
  - Endpoints: ICU mortality, in-hospital mortality

# ICU survival

- Independent variable: ED LOS  $\geq$  6 hours after admit
- 50,322 pts., 1036 w/delayed transfer
- Similar age, gender, DNR status, APACHE
- ICU patients with >6 hour delay in admission had higher ICU and hospital mortality, as well as longer length of stay

# Summary Article

- Bernstein S, et al: The Association between ED Crowding and Patient-Oriented Outcomes. *Academic Emergency Medicine*; Jan 2009.

# Optimizing Patient Flow

- Key question:
- What is improvement?

# Institute for Healthcare Improvement (IHI) Definition of Improvement

Minimize delays and increase throughput while assuring that high performance in flow is not at the expense of poor quality

# Top Causes of Patient Flow Failures

- Failure to understand delays
  - Lack of timely, targeted data
- Failure to manage variability
  - Eliminate artificial surges in demand
- Lack of coordinated and tiered responses to high census periods
- Failure to manage and sustain change
  - Facility-wide commitment
  - Senior leadership involvement

# Fundamental Dilemma Faced by Hospitals

- In today's healthcare environment, hospitals cannot survive financially unless they operate near capacity
- Maximizing functional capacity and operational efficiency is key

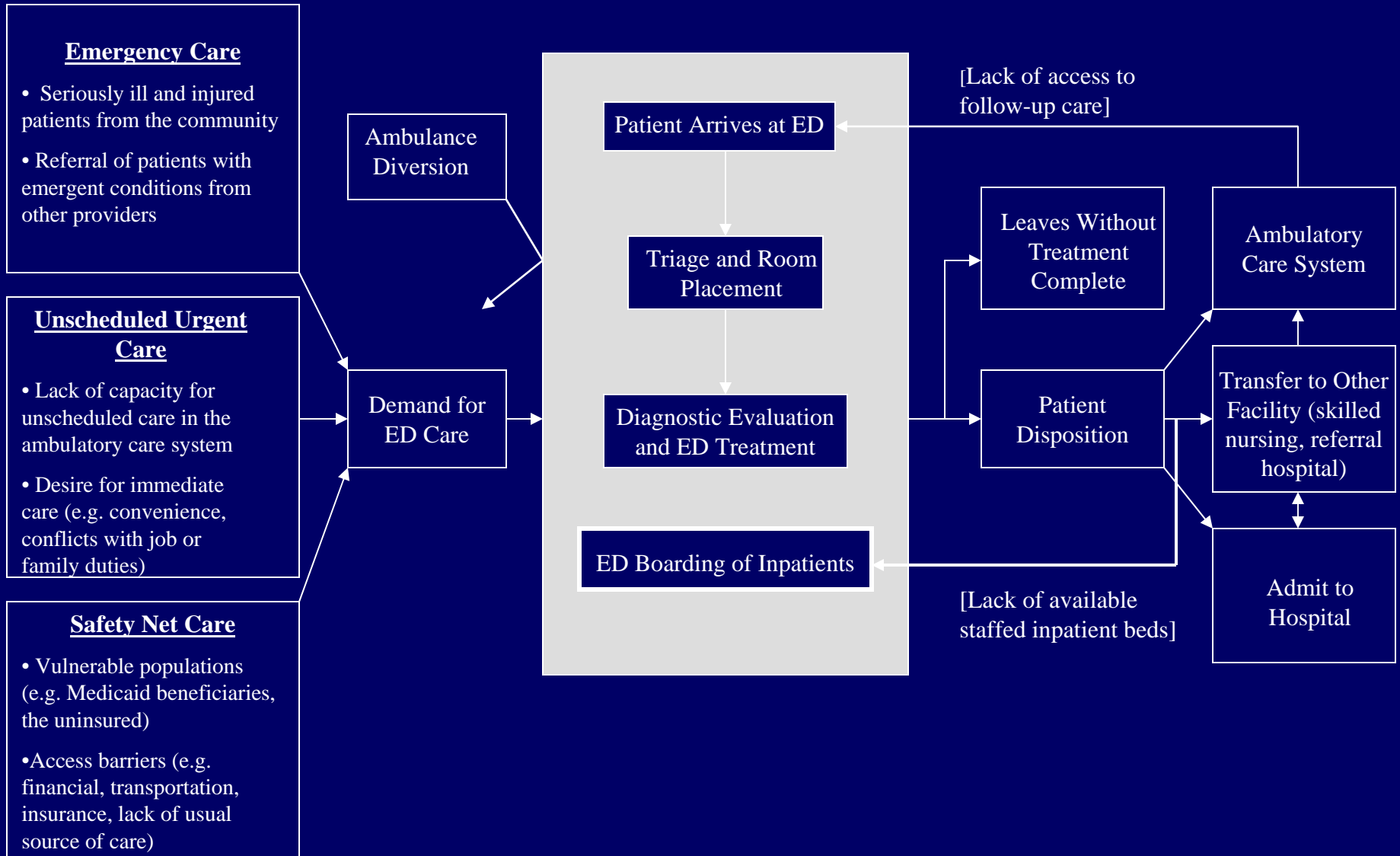
# Key Best Practices

- **Make a commitment to evidence-based operations**
- **Develop a system-wide view of capacity management with clear lines of responsibility**
- **Eliminate unnecessary variation in common tasks**

# INPUT

# THROUGHPUT

# OUTPUT



# Acute Care System

# A New Era of Operations Management in U.S. Hospitals

- Hospitals: Adopt operations management techniques and IT improvements to enhance patient flow, supported by training and certification organizations.
- CEOs: Lead the effort to improve patient flow
- Hospitals: End boarding and diversion, supported by CMS working group, JCAHO.

# High Impact Strategies for Improving Patient Flow

- ACEP Task Force Report on Boarding
  - April 2008
- What selected strategies have been shown to improve patient flow and alleviate ED boarding?
- <http://www.acep.org/WorkArea/downloadasset.aspx?id=37960>

# High Impact Hospital-Wide Strategies

- Full Capacity Protocol
  - Viccellio
- Elective surgery smoothing
- Earlier inpatient discharges

# Elective Surgical Flow

- **Managing artificial variation in demand**
- **The secret: you reduce delays  
AND you can do more surgeries!**

# Natural vs. Artificial Demand

- Natural variation
  - Stochastic and predictable using queuing theory
- Artificial variation
  - Wide variations in demand created by scheduling bottlenecks (e.g. OR block schedules)
  - Creates greater variation in demand than the predictably unpredictable demand for emergency admissions

# Variability in Demand

- Program for management of variability in health care delivery
  - <http://management.bu.edu/research/hcmrc/mvp/index.asp>
- Institute for Healthcare Optimization
  - <http://www.ihoptimize.org>
- Litvak, Long, Cooper, and McManus. Emergency department diversion causes and solutions. Acad Emerg Med. 2001 Nov;8(11):1108-10.

# Earlier Inpatient Discharges

- The myth of everyone out by 11.....



# Earlier Inpatient Discharge Process

- Begin admission with anticipated date of discharge
- Develop a discharge checklist
- Orchestrate events around planned discharge time:
  - Pharmacy
  - Transport
  - Discharge instructions
- All of these steps should be integrated within enterprise EHR systems

# Earlier Inpatient Discharges

- Requires senior leadership support to hold inpatient managers accountable for goals
- Project management and data support are critical
- Find an “early adopter” unit with a key inpatient physician and nurse manager

# Hospital Wide View of Patient Flow

**The goal:**

**Develop a system-wide view of patient flow and operations management with clear lines of responsibility**

– Is your CEO on board?

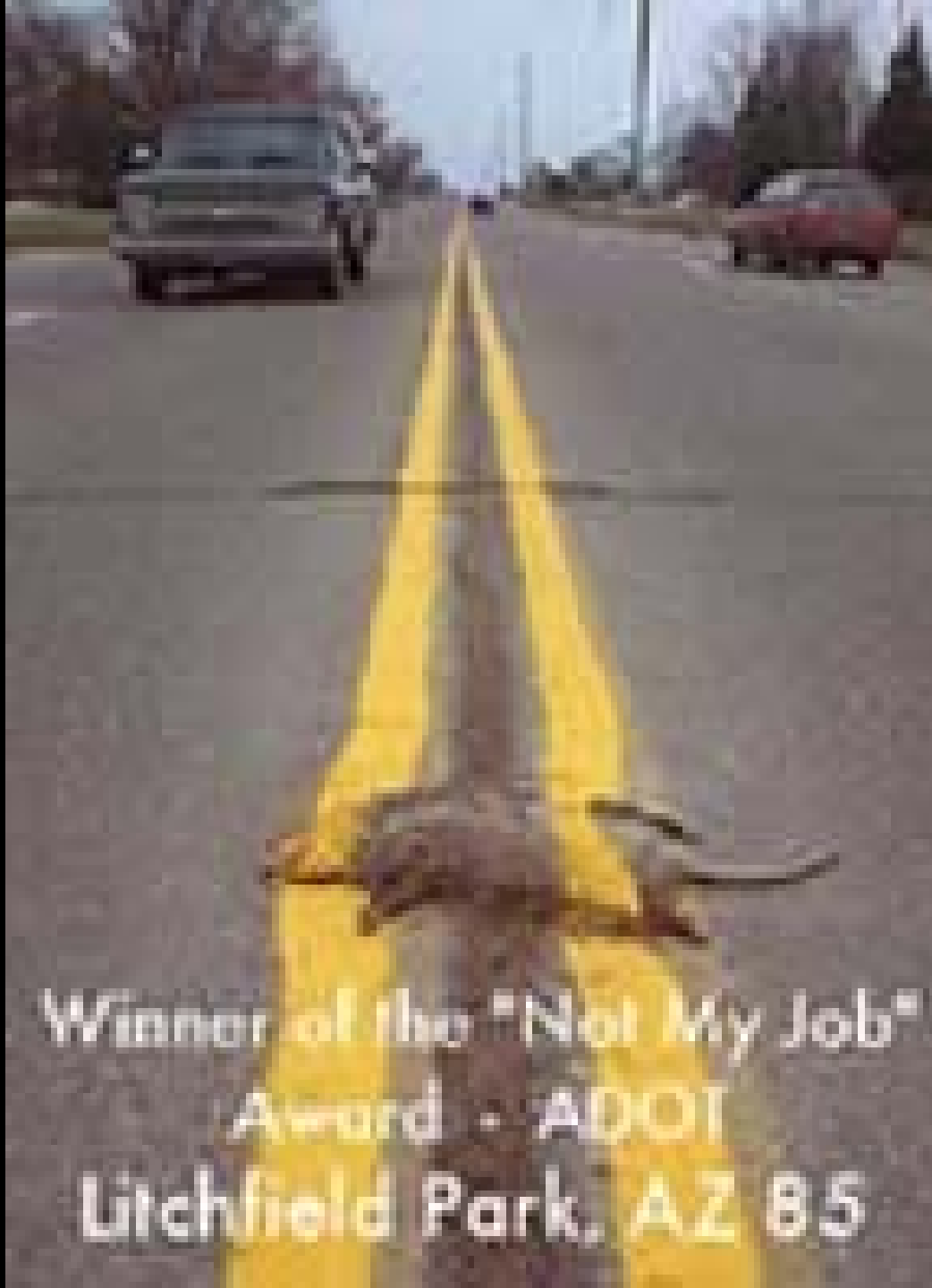
# Leadership on Flow

- If your hospital CEO doesn't have patient flow on his/her short list, you are in trouble.
- It is your responsibility to get these issues on the CEO's short list.

# The Hospital with a Disengaged CEO

"When I go, I want to die peacefully  
in my sleep like my grandfather  
did...

not screaming like the passengers  
in his car."



Winner of the "Not My Job"  
Award - ADOT  
Litchfield Park, AZ 85

# Ownership

**"In the history of the world,  
no one has ever washed a  
rented car."**

-Larry Summers, Former President  
of Harvard

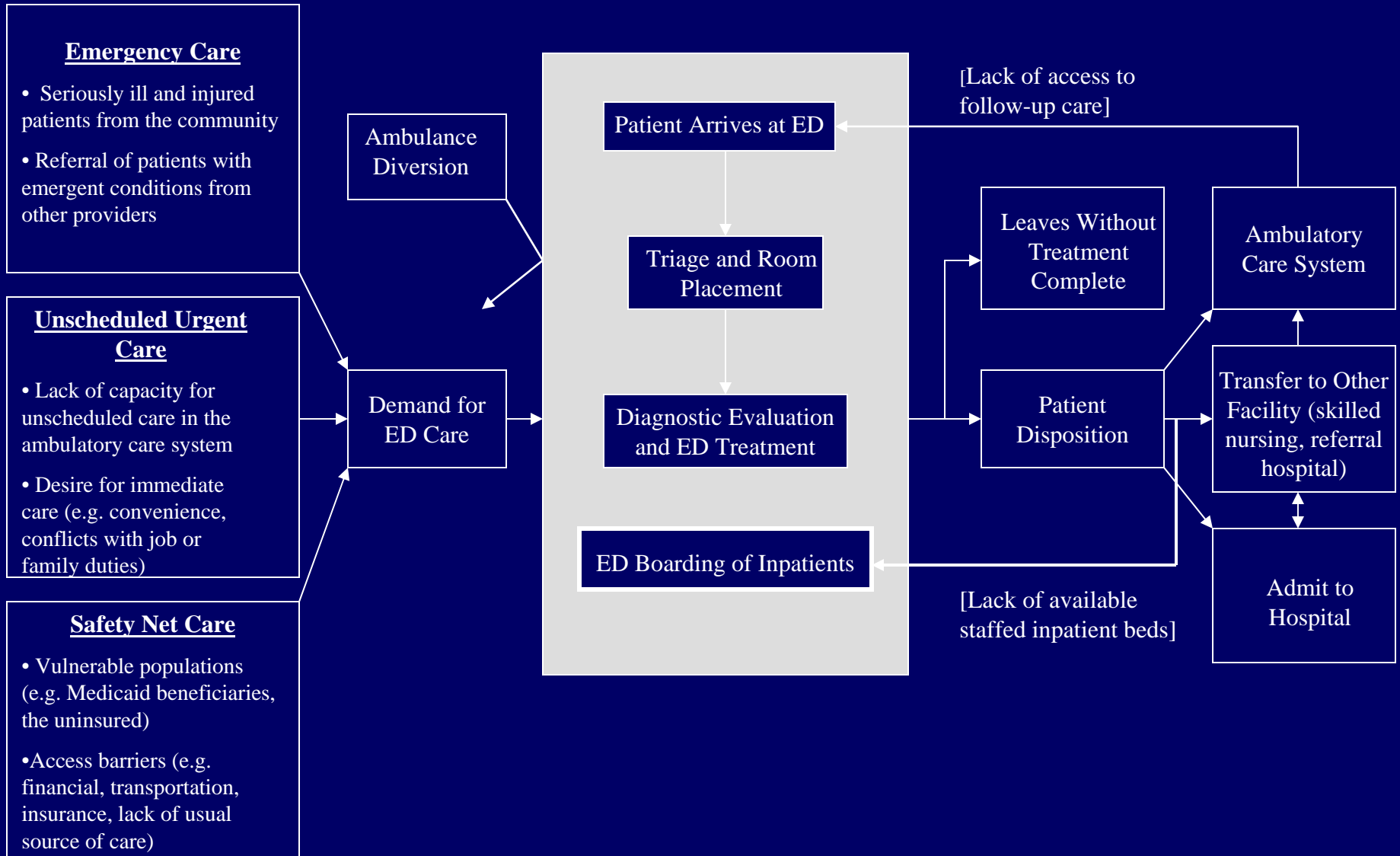
# ED Based Patient Flow Strategies

- Theories of flow
- Patient streaming
- New intake models

# INPUT

# THROUGHPUT

# OUTPUT



# Acute Care System

---

# Acknowledgements

## Utah/AHRQ Team Members

- Brent Asplin MD, Chairman, Emergency Medicine Mayo Clinic (Co-Chair)
- Jody Crane MD, Institute for Healthcare Improvement (IHI) (Co-Chair)
- James Augustine MD, Director Clinical Operations, Emergency Medicine Physicians (EMP) Steering Committee Liaison
- Theodore Chan MD, Chairman Emergency Medicine, UC San Diego Medical Center
- Dickson Cheung MD, HCA Healthcare, Denver
- Mark McClellan MN, RN, GWU-The Center for Health Care Quality
- Sherri Lynne Almeida RN, PhD, ENA Emergency Nurses Association
- David Garvey MD, The T System
- Jennifer Wiler MD, MBA, Washington University School of Medicine
- Shari Welch MD, Fellow, Intermountain Institute for Health Care Delivery Research
- John Lyman MD, CMO, Premier Health Care Services Inc.
- Todd Taylor MD, FACEP, Physician Executive, Microsoft Corp.
- Dave Eitel, MD, Wellspan Health System, ESI Workgroup
- Frank Zilm, D.ARCH, Frank Zilm and Associates

# Key Concepts – Lean Healthcare

Operations management philosophy pioneered by Toyota centered around the following:

- Creating patient value

- Eliminating waste in all its forms

  - Transportation

  - Inventory

  - Movement

  - Waiting

  - Over Processing

  - Over Production

  - Defects

  - Human Creativity

- Promoting flow

- Continuous improvement

---

# Lean Implications for Intake

- **Creating Patient Value Streams**
- **Eliminate virtually all steps between the patient and the provider (waste)**
- **Only use beds for value-added activity (keep vertical patients vertical)**
- **Standardize everything (clinical = evidence based, flow = rigor in process design)**

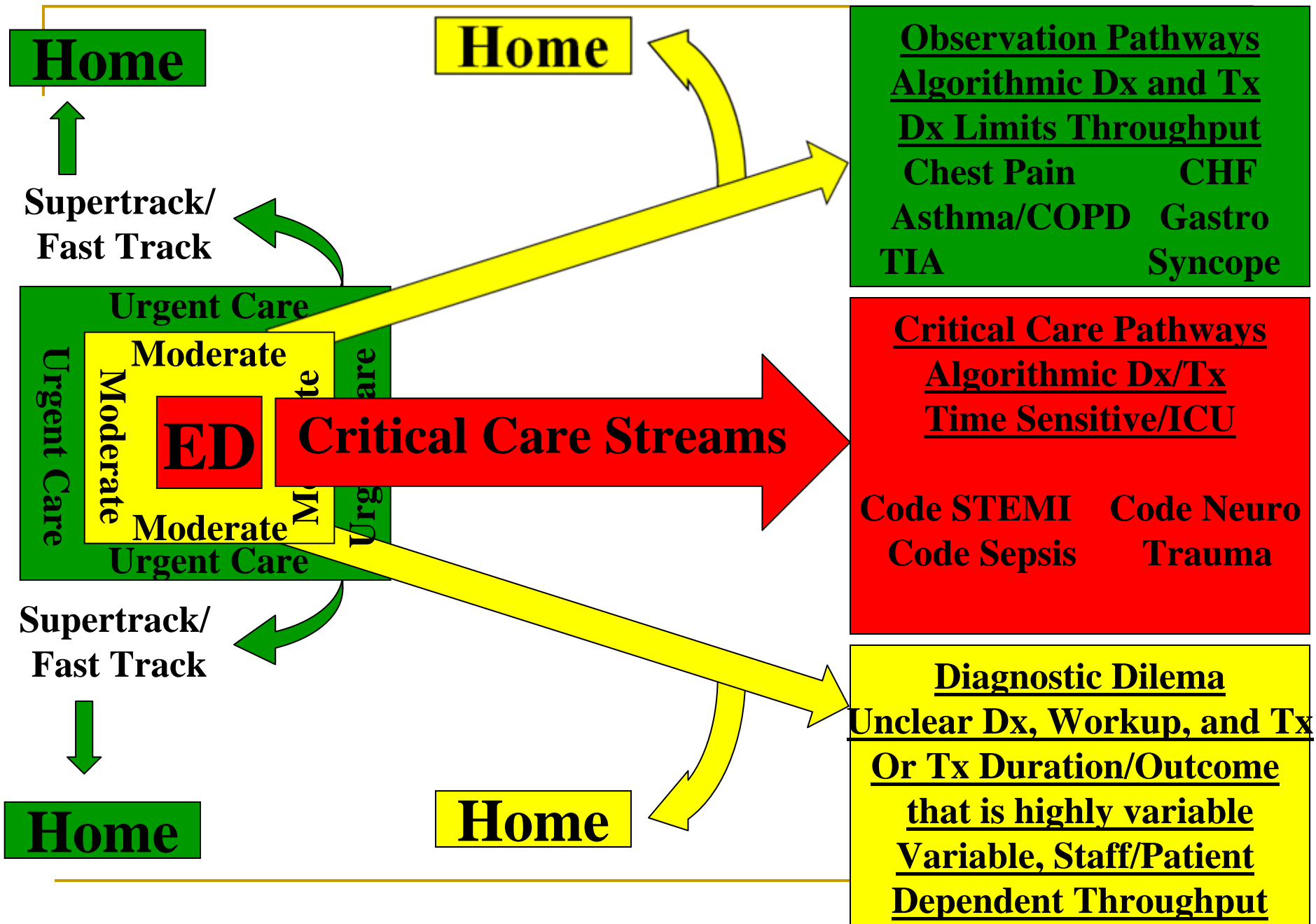
# Bottlenecks and Non-bottlenecks

- A resource is either a *bottleneck* or *non-bottleneck*
  - *Bottleneck*- A resource that has the capacity equal to or less than the demand placed upon it
  - *Non-bottleneck*- A resource that has a capacity that is greater than the demand placed upon it
- An hour lost at a *bottleneck* is an hour lost for the entire system
- Time saved at a *non-bottleneck* is a mirage
- Management's job, therefore, is to *identify, challenge, and intensely manage* system constraints (i.e., the bottlenecks)

---

# The New Conceptual Framework

- **The Breathing ED, responding to census changes**
- **Throughout the week and by hour of day, ED process “breathes” in response to changing patient demands in a deliberate, pre-planned manner**
- **Requires in-depth understanding of patient streams, demand (volume), patient acuity, service capacity of allocated resources**



---

# Critical Intake Design Influencers

- **Patient volume/Census**
  - **High/Low census strategies**
  - **Volume bands**
  - **Staffing paradigms/requirements**
  - **Teaching vs community**
  - **Trauma vs. Non-trauma**
  - **Pediatric EDs**
  - **Information technology integration/utilization**
-

# The Approach to Patient Streaming – Framing Patient Needs

- ❑ **ESI 4,5 “Super Track” Patients – Need to be seen quickly so they can go home, algorithmic dx and tx, keep vertical**
- ❑ **ESI 3 “Needle in the haystack” Patients – Need to be seen quickly to get ancillaries and treatment started, care should be forward-moving, flow-based**
- ❑ **ESI 1,2 “True ED” Patients – Need to be seen quickly to begin stabilizing therapy and institute critical care pathways, Care begins inpatient pathway**

---

# Nurse Triage Protocols

- **Ok but not ideal**
- **Good if all MDs are in agreement, RNs have reliable assessments and use them**
  - **Otherwise, create waste in the form of over-ordering, rework**
- **Should only be implemented when there are temporary waiting periods, not as operational approach to compensate for not getting patients in front of providers**
- **EDIS systems need to support efficiently**

# Traditional “Fast Track”

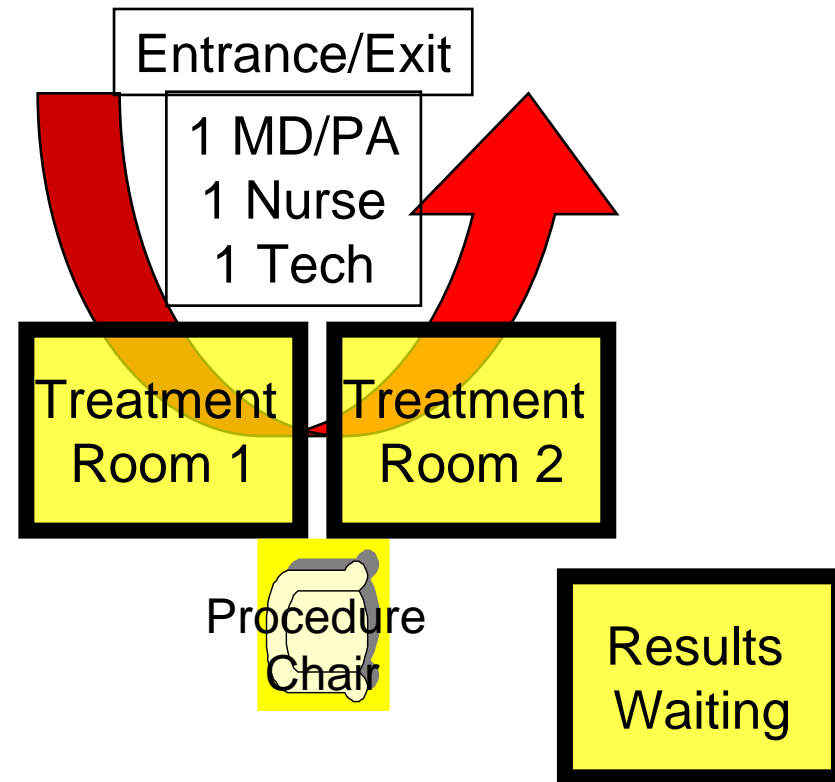
- **Complex and can be overrun**
- **Most function as slow tracks**
- **Issues:**
  - **Patients who “don’t belong here” are frequently afterthought from process and HR perspective**
  - **Patients waste critical bed time**
  - **Frequent location for overflow from Main ED – wrong providers, wrong location, flow compromised**

# ESI 4,5 Fast Track / Super Track

- **Could be treated in outpatient setting, but don't have access**
- **Universally do well when discharged**
- **Characteristics**
  - **No testing**
  - **POC testing**
  - **Traditional, but simple, algorithmic**
  - **Keep vertical**

# Super Track – Lean Fast Track

- **2-3 bed unit in or near triage**
- **Point of use supplies**
- **Well-orchestrated provider activities**
- **RW area**
- **Designed with an eye on demand and system capacity**



---

# MD in Triage (Team Triage)

- Excellent for getting patient and provider together quickly
  - Often does not match resources to patient need
    - Over-resourced for Super-Track patients
    - Under-resourced for complex ESI 3s
  - Difficult to avoid hand-offs
    - Waste of re-work
-



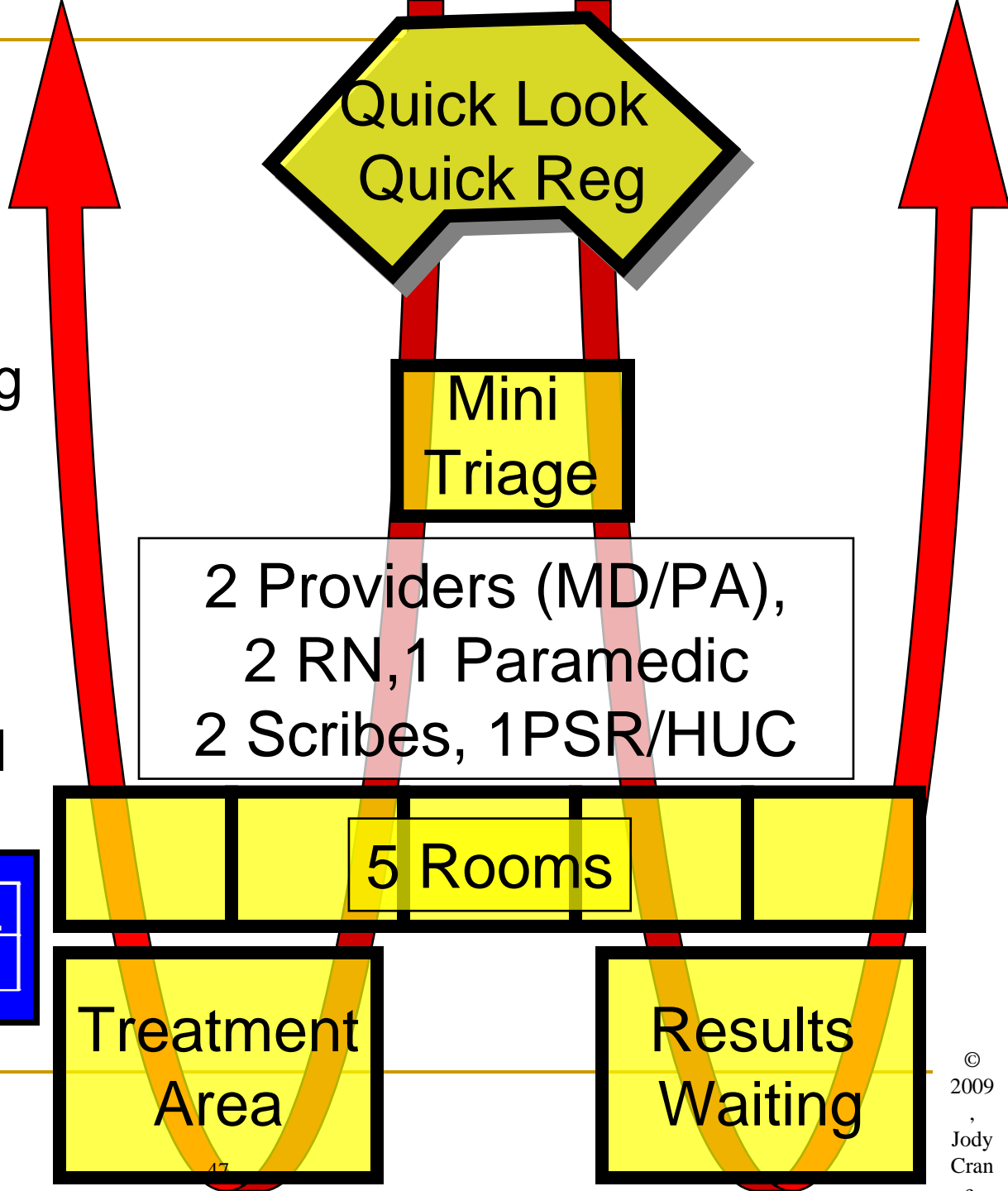
---

# Intake Teams

- **Comprehensive strategies Door to Doc, RATED, RAZ**
- **Designed incorporating critical Lean and queuing elements**
  - **Designed to meet patient demand**
  - **Rigorous standardization of diagnostics, treatment, and patient flow**
- **Can make things worse if not careful (Cookie cutter approach, poor design)**
- **Must change process fundamentally**

# “Intake Teams”\*

- Team of providers utilizing an “intake team” mentality for promptly assessing, treating, and discharging level 3 patients



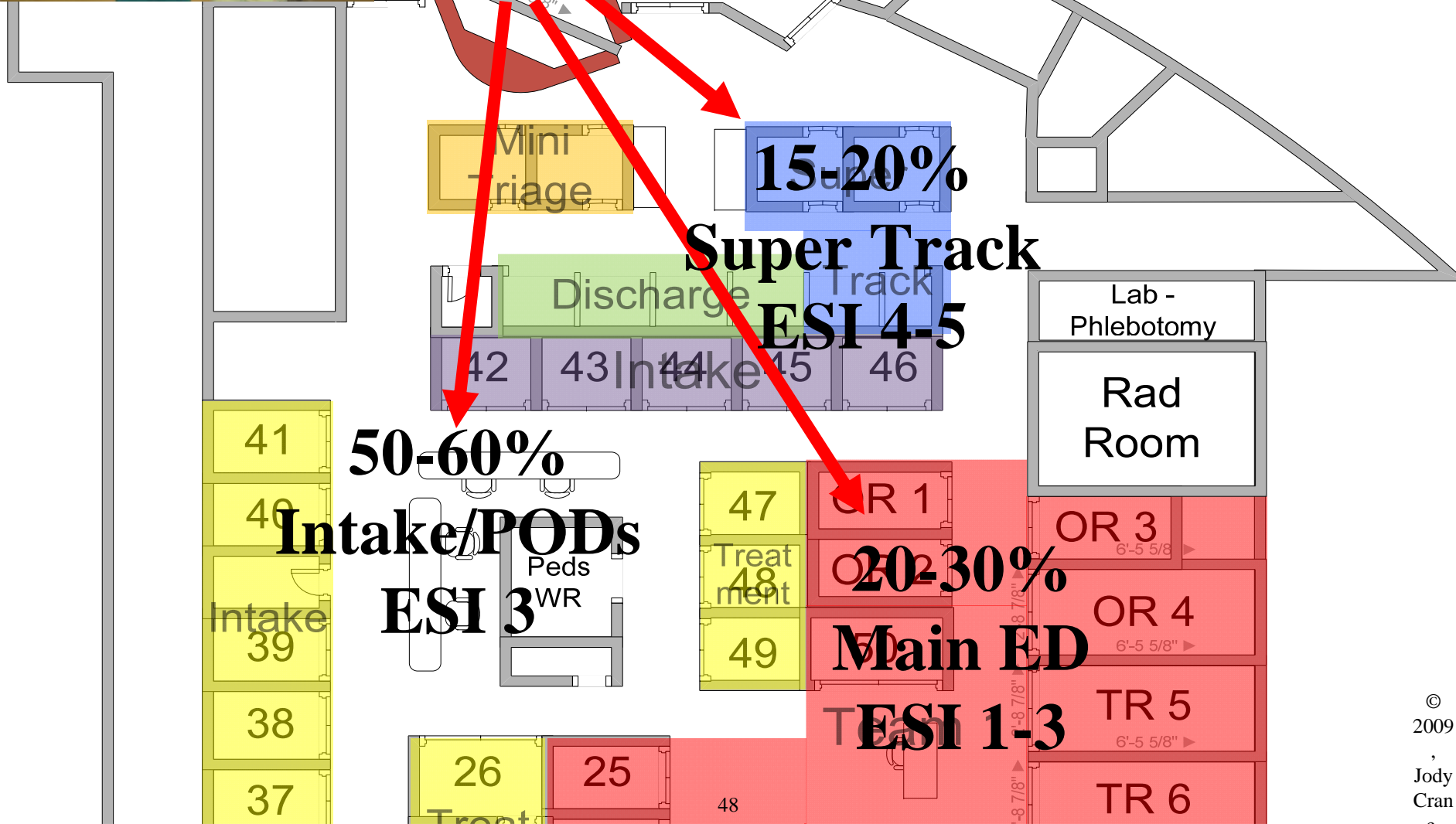


# Emergency Streaming

## Pivot RN

# Pivot RN

Initially sorts ST patients  
 Identify Level 1,2 patients  
 Patient placement



# Super Track Volume Bands

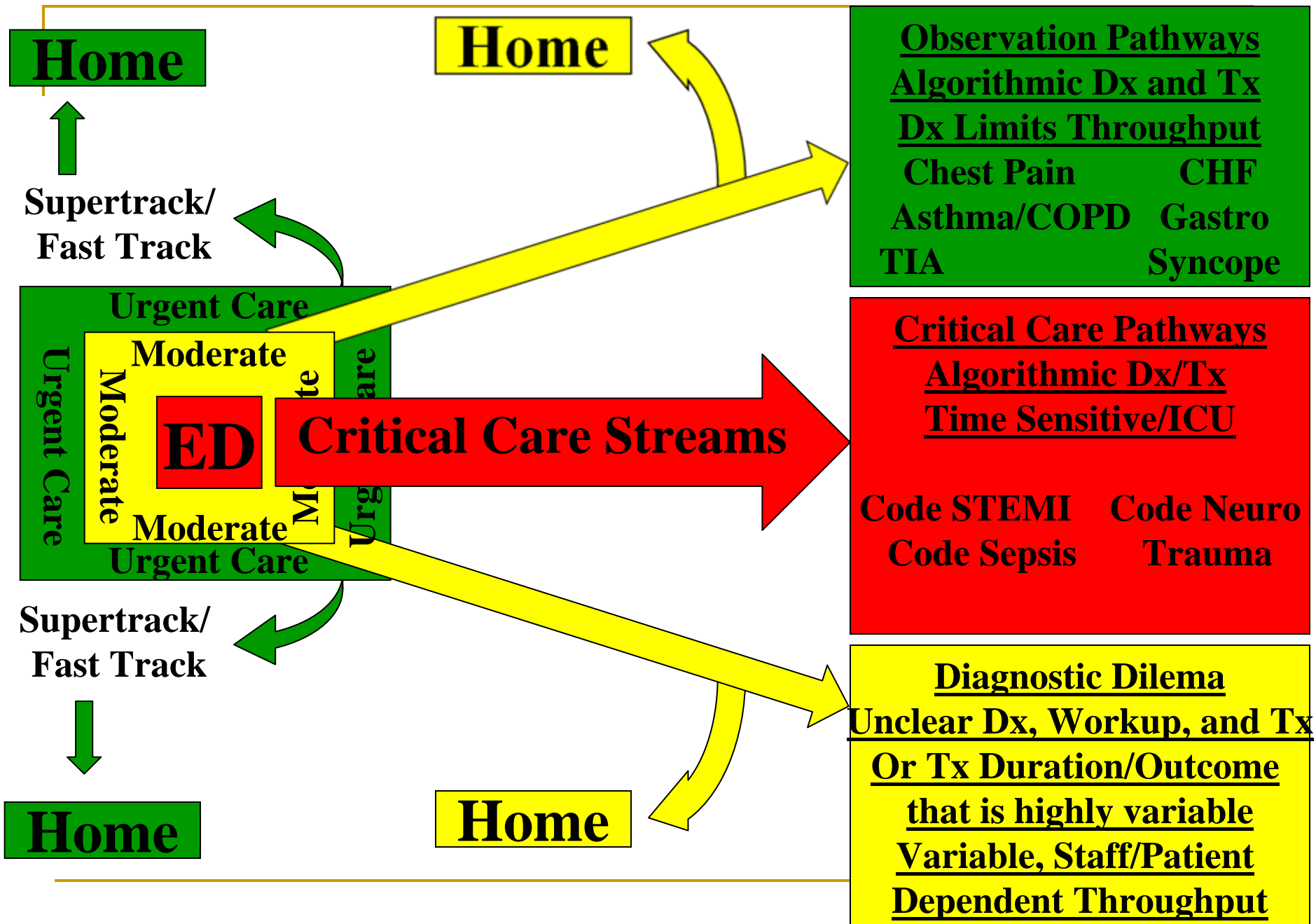
ESD Distribution		Change on this page only	Projected Hourly Volumes												
			Hour	Average Patient Arrivals by Hour based on Annual Volumes											
			10,000	20,000	30,000	40,000	50,000	60,000	70,000	80,000	90,000	100,000	110,000	120,000	
Level 1	0%		0:00	0.32	0.65	0.97	1.29	1.61	1.94	2.26	2.58	2.91	3.23	3.55	3.87
Level 2	10%		1:00	0.24	0.48	0.71	0.95	1.19	1.43	1.66	1.90	2.14	2.38	2.62	2.85
Level 3	50%		2:00	0.18	0.35	0.53	0.70	0.88	1.05	1.23	1.40	1.58	1.75	1.93	2.10
Level 4	35%		3:00	0.17	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	1.85	2.02
Level 5	5%		4:00	0.18	0.35	0.53	0.70	0.88	1.06	1.23	1.41	1.58	1.76	1.93	2.11
Level 3 pot FT	5%		5:00	0.12	0.24	0.36	0.48	0.60	0.73	0.85	0.97	1.09	1.21	1.33	1.45
			6:00	0.17	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	1.85	2.02
			7:00	0.22	0.44	0.65	0.87	1.09	1.31	1.53	1.74	1.96	2.18	2.40	2.62
Please enter the target MD/PA/NP productivity		3.00 pts/hr	8:00	0.35	0.70	1.05	1.40	1.74	2.09	2.44	2.79	3.14	3.49	3.84	4.19
			9:00	0.49	0.98	1.48	1.97	2.46	2.95	3.45	3.94	4.43	4.92	5.42	5.91
			10:00	0.61	1.21	1.82	2.43	3.03	3.64	4.25	4.86	5.46	6.07	6.68	7.28
			11:00	0.61	1.23	1.84	2.46	3.07	3.68	4.30	4.91	5.53	6.14	6.75	7.37
			12:00	0.67	1.34	2.01	2.68	3.35	4.03	4.70	5.37	6.04	6.71	7.38	8.05
			13:00	0.72	1.44	2.16	2.88	3.60	4.33	5.05	5.77	6.49	7.21	7.93	8.65
			14:00	0.60	1.19	1.79	2.38	2.98	3.57	4.17	4.76	5.36	5.95	6.55	7.14
			15:00	0.60	1.19	1.79	2.39	2.99	3.58	4.18	4.78	5.37	5.97	6.57	7.17
			16:00	0.51	1.02	1.53	2.04	2.55	3.06	3.57	4.08	4.59	5.10	5.61	6.12
			17:00	0.56	1.12	1.69	2.25	2.81	3.37	3.93	4.50	5.06	5.62	6.18	6.74
			18:00	0.67	1.33	2.00	2.66	3.33	3.99	4.66	5.32	5.99	6.65	7.32	7.98
			19:00	0.68	1.35	2.03	2.70	3.38	4.06	4.73	5.41	6.08	6.76	7.44	8.11
			20:00	0.73	1.47	2.20	2.93	3.67	4.40	5.14	5.87	6.60	7.34	8.07	8.80
			21:00	0.62	1.24	1.86	2.48	3.11	3.73	4.35	4.97	5.59	6.21	6.83	7.45
			22:00	0.52	1.04	1.56	2.08	2.61	3.13	3.65	4.17	4.69	5.21	5.73	6.25
			23:00	0.44	0.87	1.31	1.75	2.18	2.62	3.06	3.49	3.93	4.37	4.80	5.24
				= 1 provider 3 bed Super Track				seeing between	1.98	and	3.00	pts/hr			
				= 2 provider 6 bed Super Track				seeing between	3.00	and	6.00	pts/hr			
				= 3 provider 9 bed Super Track				seeing between	6.00	and	9.00	pts/hr			
				= 4 provider 12 bed Super Track				seeing between	9.00	and	12.00	pts/hr			
				= 5 provider 15 bed Super Track				seeing between	12.00	and	15.00	pts/hr			

# Intake Volume Bands

ESI Distribution		Change on this page only	Projected Hourly Volumes												
			Hour	Average Patient Arrivals by Hour based on Annual Volumes											
			10,000	20,000	30,000	40,000	50,000	60,000	70,000	80,000	90,000	100,000	110,000	120,000	
Level 1	0%		0:00	0.48	0.97	1.45	1.94	2.42	2.91	3.39	3.87	4.36	4.84	5.33	5.81
Level 2	10%		1:00	0.36	0.71	1.07	1.43	1.78	2.14	2.50	2.85	3.21	3.57	3.92	4.28
Level 3	50%		2:00	0.26	0.53	0.79	1.05	1.31	1.58	1.84	2.10	2.36	2.63	2.89	3.15
Level 4	35%		3:00	0.25	0.50	0.76	1.01	1.26	1.51	1.77	2.02	2.27	2.52	2.77	3.03
Level 5	5%		4:00	0.26	0.53	0.79	1.06	1.32	1.58	1.85	2.11	2.37	2.64	2.90	3.17
Level 3 pot FT	20%		5:00	0.18	0.36	0.54	0.73	0.91	1.09	1.27	1.45	1.63	1.81	2.00	2.18
		© Jody Crane, MD, MBA 2007	6:00	0.25	0.50	0.76	1.01	1.26	1.51	1.77	2.02	2.27	2.52	2.77	3.03
			7:00	0.33	0.65	0.98	1.31	1.64	1.96	2.29	2.62	2.94	3.27	3.60	3.92
Please enter the target MD/PA/NP productivity		3.00 pts/hr	8:00	0.52	1.05	1.57	2.09	2.62	3.14	3.66	4.19	4.71	5.23	5.76	6.28
			9:00	0.74	1.48	2.22	2.95	3.69	4.43	5.17	5.91	6.65	7.39	8.12	8.86
			10:00	0.91	1.82	2.73	3.64	4.55	5.46	6.37	7.28	8.19	9.10	10.02	10.93
			11:00	0.92	1.84	2.76	3.68	4.61	5.53	6.45	7.37	8.29	9.21	10.13	11.05
			12:00	1.01	2.01	3.02	4.03	5.03	6.04	7.05	8.05	9.06	10.06	11.07	12.08
			13:00	1.08	2.16	3.24	4.33	5.41	6.49	7.57	8.65	9.73	10.81	11.90	12.98
			14:00	0.89	1.79	2.68	3.57	4.46	5.36	6.25	7.14	8.03	8.93	9.82	10.71
			15:00	0.90	1.79	2.69	3.58	4.48	5.37	6.27	7.17	8.06	8.96	9.85	10.75
			16:00	0.76	1.53	2.29	3.06	3.82	4.59	5.35	6.12	6.88	7.65	8.41	9.18
			17:00	0.84	1.69	2.53	3.37	4.21	5.06	5.90	6.74	7.59	8.43	9.27	10.12
			18:00	1.00	2.00	2.99	3.99	4.99	5.99	6.99	7.98	8.98	9.98	10.98	11.98
			19:00	1.01	2.03	3.04	4.06	5.07	6.08	7.10	8.11	9.12	10.14	11.15	12.17
			20:00	1.10	2.20	3.30	4.40	5.50	6.60	7.70	8.80	9.90	11.00	12.10	13.20
			21:00	0.93	1.86	2.79	3.73	4.66	5.59	6.52	7.45	8.38	9.32	10.25	11.18
			22:00	0.78	1.56	2.35	3.13	3.91	4.69	5.47	6.25	7.04	7.82	8.60	9.38
			23:00	0.66	1.31	1.97	2.62	3.28	3.93	4.59	5.24	5.90	6.55	7.21	7.86
				= 1/2 Team*1MD,1RN ED Volume Between			1.98	and	3.00	pts/hr					
				= 1 team ED Volume Between			3.00	and	6.00	pts/hr					
				= 2 teams ED Volume Between			6.00	and	9.00	pts/hr					
				= 3 teams ED Volume Between			9.00	and	12.00	pts/hr					
				= 4 teams ED Volume Between			12.00	and	15.00	pts/hr					
			*Team = 1 MD, 1 MLP, 2 RN, 1 Paramedic or tech, 1 Unit coordinator, 1 Patient Liaison, 2 Scribes												
			*Team = 5 intake beds, 7-8 treatment beds												

# Main Issues with Intake Solutions

- When to segment and risk of over segmentation
  - Over segmentation = idle providers = waste
- Triage out strategies for "non-emergency" patients – Currently popular, but does not help system (unless part of a national movement in the context of a medical home)
- Front end strategies that lead to 2 providers seeing the patient and obvious hazards with handoffs.
- Physician payment creates incentive issues
- Matching capacity and demand



# What about ED Discharge?

- 85% of ED patients go home
- Huge opportunity for optimizing flow
  - Often ignored
- Begging for new technology solutions
  - RFID tracking?
- Most EDIS tracking boards fail at the point of discharge
  - Used to block beds and regulate workload

# ED Discharge Teams

- Culturally challenging
  - Disrupts primary nursing model
- Effective models exist
  - Manage patient discharge instructions
  - Optimize service aspects of visit
  - Opportunity for revenue/co-pay capture
  - Tie discharge to ED room turn

# Optimizing Flow---

## Why Do I Care?

- A non-flow ED is dangerous for patients
  - Morbidity and mortality
- A non-flow ED is a painful place to be
  - Staff and patient dissatisfaction
- A non-flow ED is a difficult place to make money

# IT Infrastructure Needs

- EHRs have done a reasonable job of utilizing clinical data to create clinical information
- EHRs have done a terrible job of utilizing operations management data to create operations management information

# Stand-Alone vs. Integrated IT Operations Solutions

- Every additional system that providers have to interact with has the potential to:
  - Create waste
  - Decrease the likelihood of “compliance”
  - Increase errors
  - Undermine a culture of high performance

# Bracing for the Future

- Hospitals that have optimized patient flow are likely to have the operational tools and infrastructure to manage the turbulent times ahead

# Three Things to Watch

- Payment reform
  - Do the incentives actually drive changes in the delivery system?
- Variability in healthcare spending
- Physician engagement

# Physician Engagement

- Key to healthcare delivery redesign
- The #1 reason to pursue tort reform

# Emergency Medicine's Threats

- More patients
  - Inadequate primary care infrastructure
  - Aging population
- Uncertainty about payment reforms
  - Bundled payments unlikely to have dramatic effect over short-term (more significant for hospitals)
  - Long-term effects could be significant (what does value sharing look like for EM?)
- New expectations
  - Interacting differently with primary care
  - Reducing readmissions

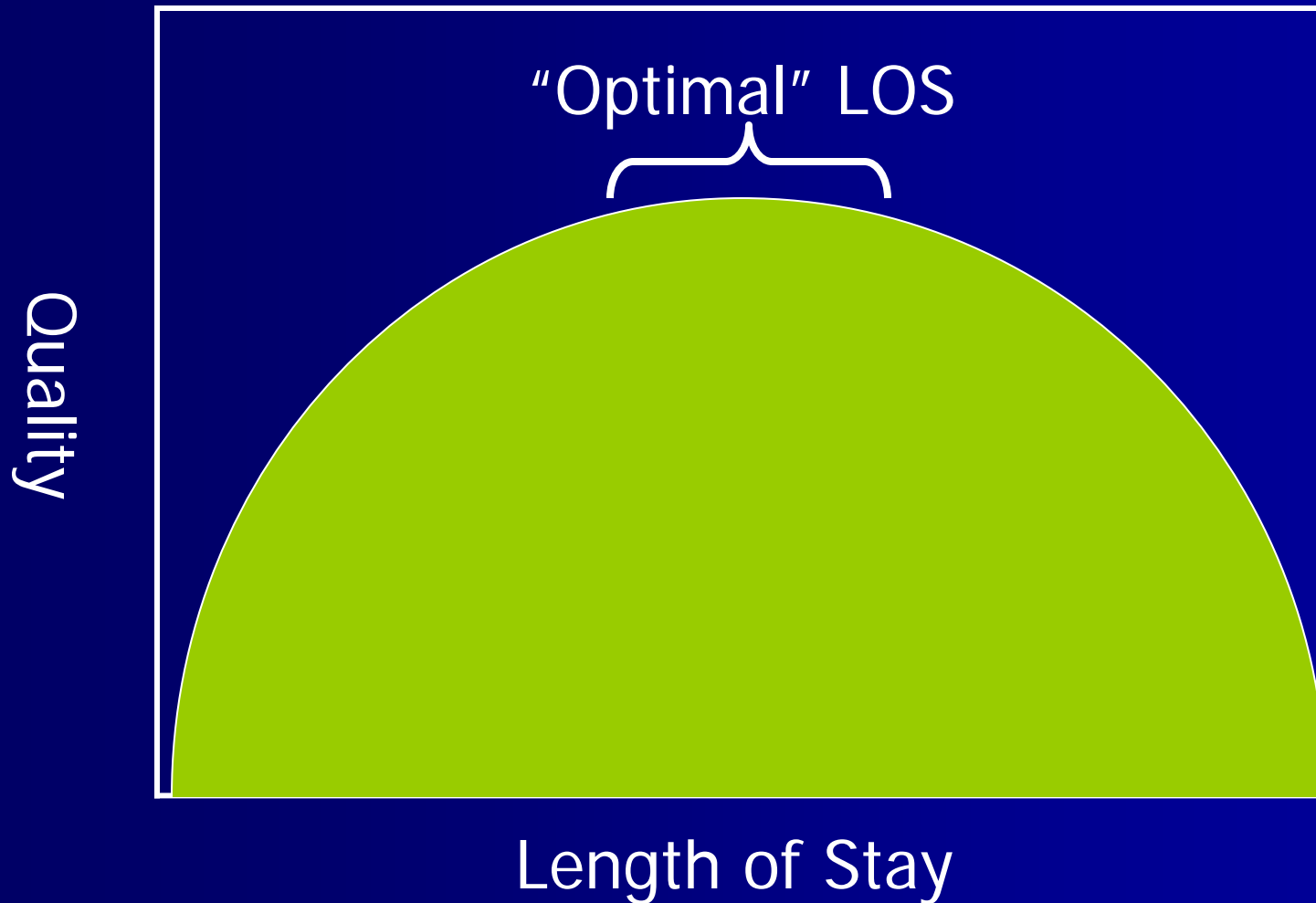
# Hospital Readmissions

- Almost 20% of Medicare beneficiaries were readmitted within 30 days
  - 50% of medical discharges had no MD bill before being readmitted
- The ED is at the center of the debate
- What interventions can safely reduce readmissions?
- How is the ED integrated with these interventions?

# New NQF and CMS Performance Measures

- Total ED length of stay
  - Stratified by admitted vs. discharged patients
- CMS has indicated possibility of adopting these measures

# Quality and Length of Stay



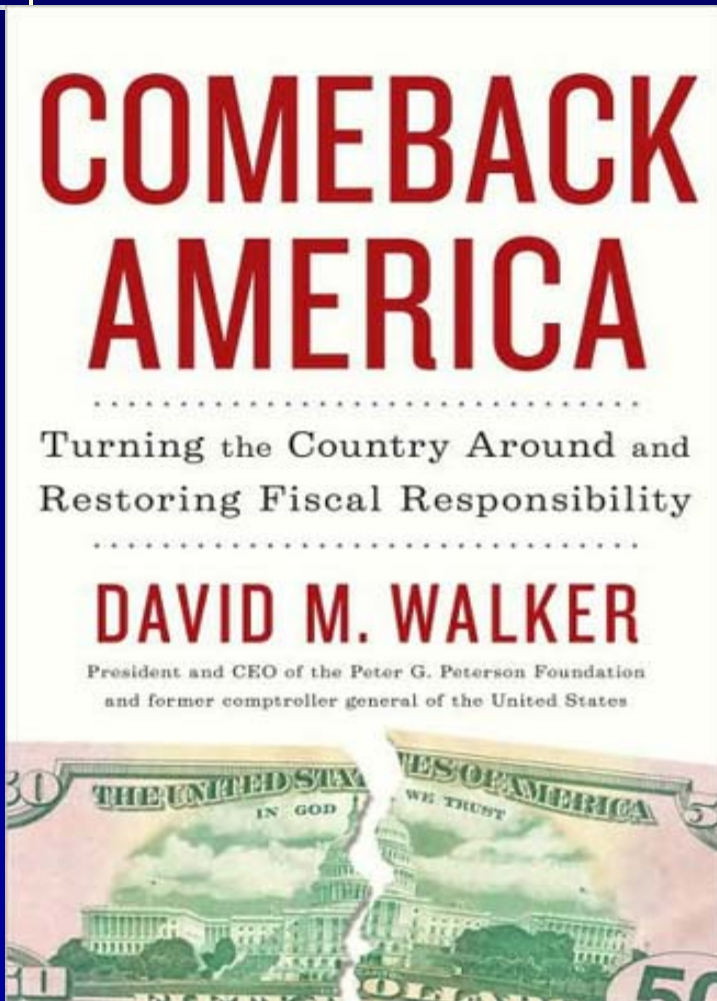
# Emergency Medicine's Opportunities

- More patients
- A chance to demonstrate value
  - 124 million patients are coming to us for a reason
- An unprecedented chance to redesign the system
  - Our perspective is indispensable
  - You are a systems expert

# Defining the Value of Emergency Care

- We make the most expensive routine decision in healthcare
- We will always be at the interface of inpatient and outpatient care
- We have a huge role in determining how patients with chronic disease are managed

# What are the Stakes?



- Long-term structural deficits:
- Social Security
  - \$7.7 trillion
- Medicare
  - \$38 trillion

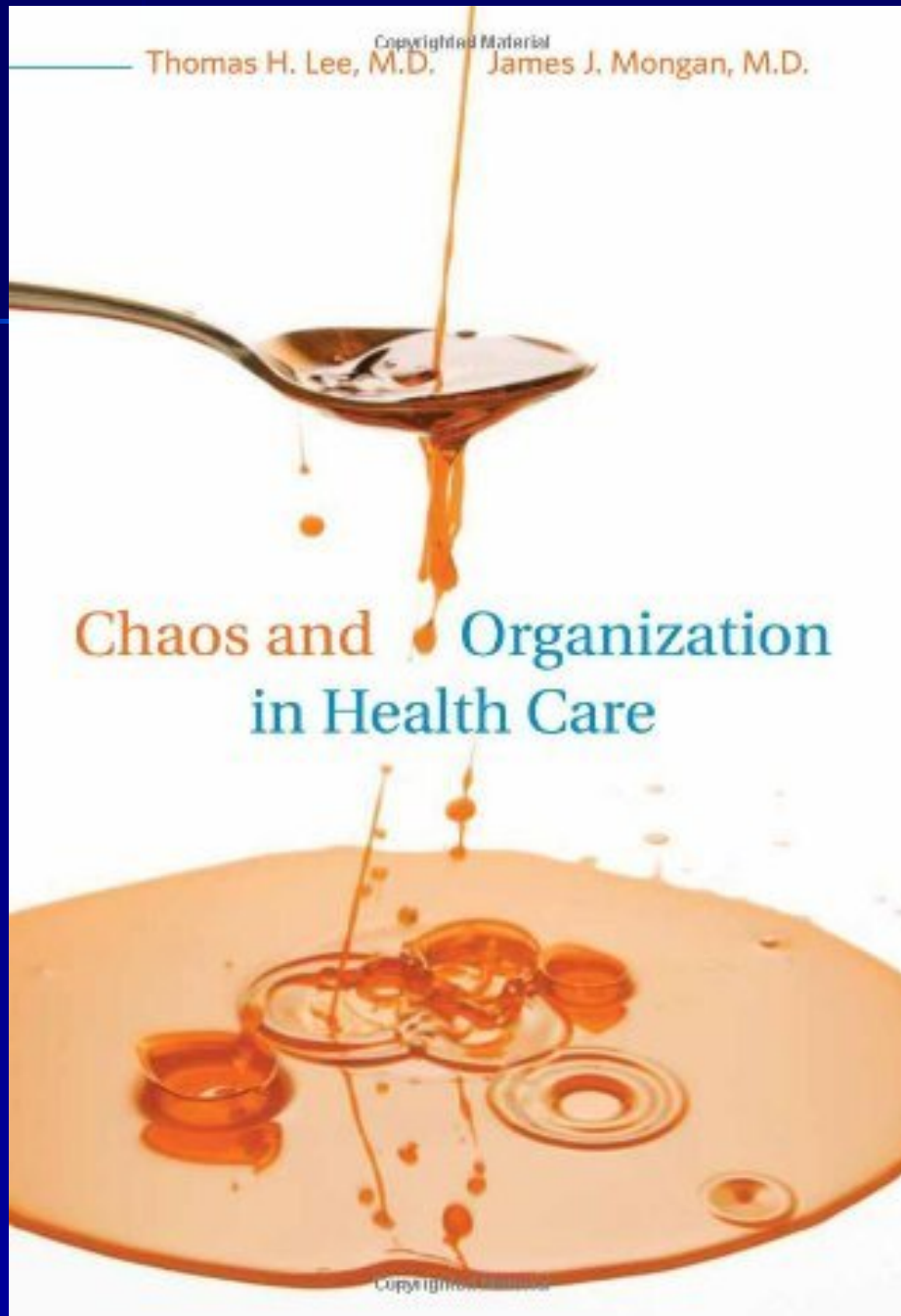
# The Cost Conundrum



"In the sharpest economic downturn that our health system has faced in half a century, many people in medicine don't see why they should do the hard work of organizing themselves in ways that reduce waste and improve quality if it means sacrificing revenue."

--Atul Gawande, MD

*The New Yorker*



- The problem is chaos.
- The solution is organization.
- The question is how we get there.

Michael E. Porter  
Elizabeth Olmsted Teisberg

# Redefining Health Care

*Creating  
Value-Based Competition  
on Results*



HARVARD BUSINESS SCHOOL PRESS

“True reform will require both moving toward universal insurance coverage and restructuring the care delivery system. These two components are profoundly interrelated, and both are essential.”

Michael Porter, PhD  
Harvard Business School

Daniel H. Pink

author of *The New York Times* bestseller

*A Whole New Mind*

**DRiVE**

The Surprising Truth  
About What Motivates Us

# Perspective

It's strange, but wherever I take my eyes, they always seem to see things from my point of view.

# The Right Vision for the Future?

"Just remember there's a fine line between a vision and a hallucination."

-Brent Eastman

# Any Questions?

Contact Information:

Asplin.Brent@mayo.edu