Designing Patient Flow in the Hospital to Make Patients Safer

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Why should we care about patient flow?

1. To make our patients safer
2. To increase throughput (volume, $$)
3. To reduce expenses (cost, $$)
4. To improve staff satisfaction
5. To improve patient satisfaction

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A question to run on …….

What can I do as a healthcare leader to improve patient flow?

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Agenda

- **Introduction** **5 minutes**
  - What is the fundamental problem?
  - What management model will help us improve it?

- **Some examples of designing flow** **15 minutes**
  - Smoothing Flow at Boston Medical Center:
    Changing the Surgical Schedule
  - Designing Flow out of the Emergency Department at Caritas Norwood Hospital

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Luckily, this type of communication does not happen in commercial aviation…….

- US Air 562 from Boston to Albany in its final approach

- Captain: “Albany this is US Air 562”

- Air Traffic Controller: “Roger US Air 562 this is Albany Control. You’ll have to hold at your present altitude. We’ve got a lot more planes in our airspace than usual. The airlines decided to add some flights but no one told us and we’ve got some rerouted planes due to bad weather in metro New York.”

•US Air 562 from Boston to Albany in its final approach

•Co-pilot: “Boy, we’ve got to get this plane down or we’ll have some angry passengers. There’s the airport. Lets pick a runway. I usually call the gates myself and find out if any are open and then I just go for it. If you don’t, the controller will give it to someone else”

•A Physician and Two Nurses Discussing a Patient in the ED Waiting to Be Admitted

•Physician: " This guy is ready to go upstairs. Its now 5pm, he came in at 10 this morning. The unit clerk called admitting but I guess they are at dinner".

•First Nurse: "Ok, I'll call around to the floors and see if there are any empty beds….I know who to call."

•Second Nurse: "Oh, I usually call the supervisor. Did you call report?"

•First Nurse: "Oh no, I leave it on the floor's voicemail just before I leave the ED with the patient so they can't slow the transfer down".

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Hospitals have been managed sub-optimally

- **Too much is happening by chance. Too little is happening by design and therefore *we function at low reliability***
- **Managers have been managing inputs: studies per FTE; deviation from budget, etc. but not *the system.***
- **The hospital is full of *batching;* Patients are admitted and discharged in batches. Tests are run in batches. Surgeries are done in batches without consideration of *the effect on the system.***
- ***Safe patient care* is easier to reach with continuous flow *and not with the artificial variability of batching!***
- **There is a need for scientific management in the hospital industry**

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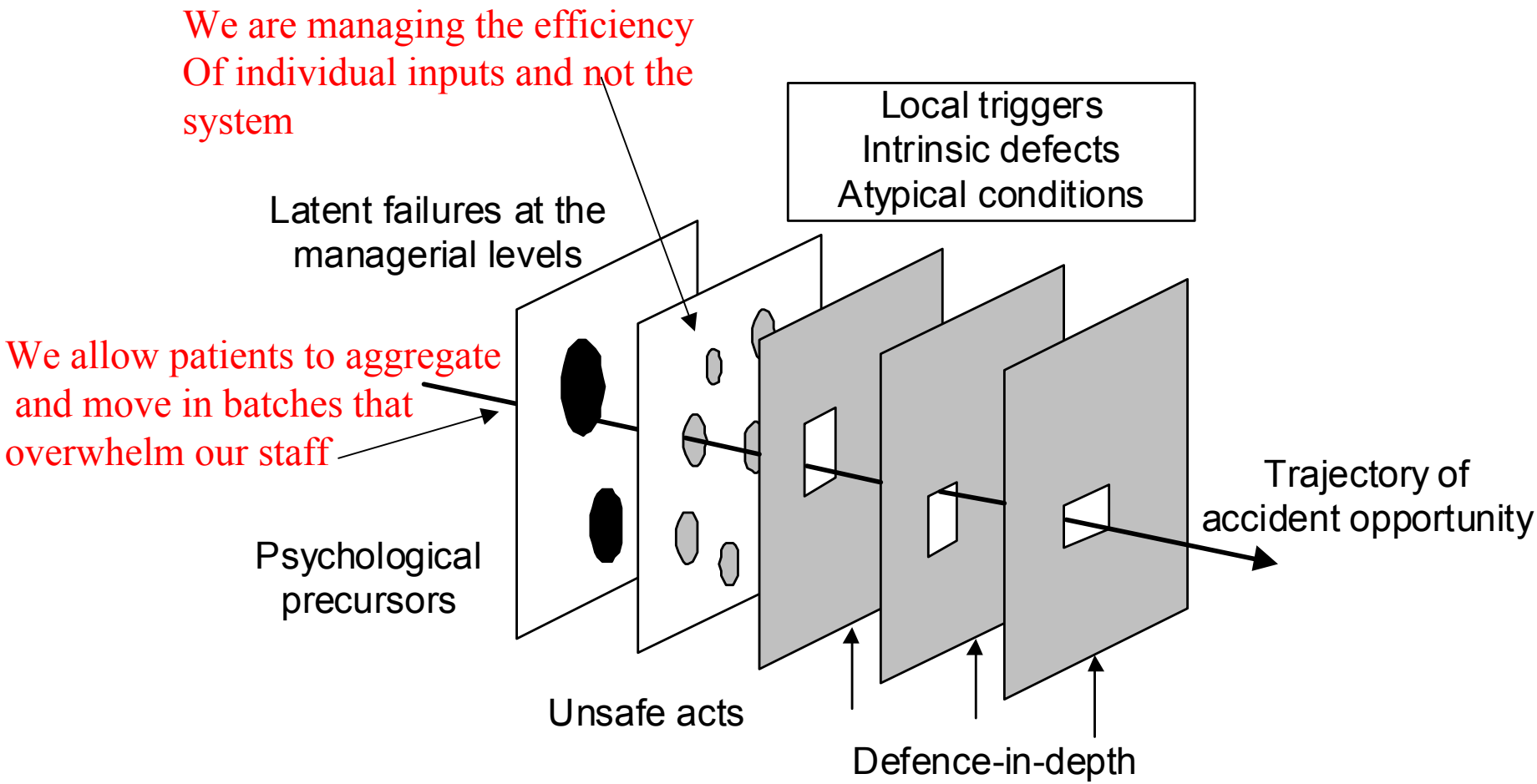
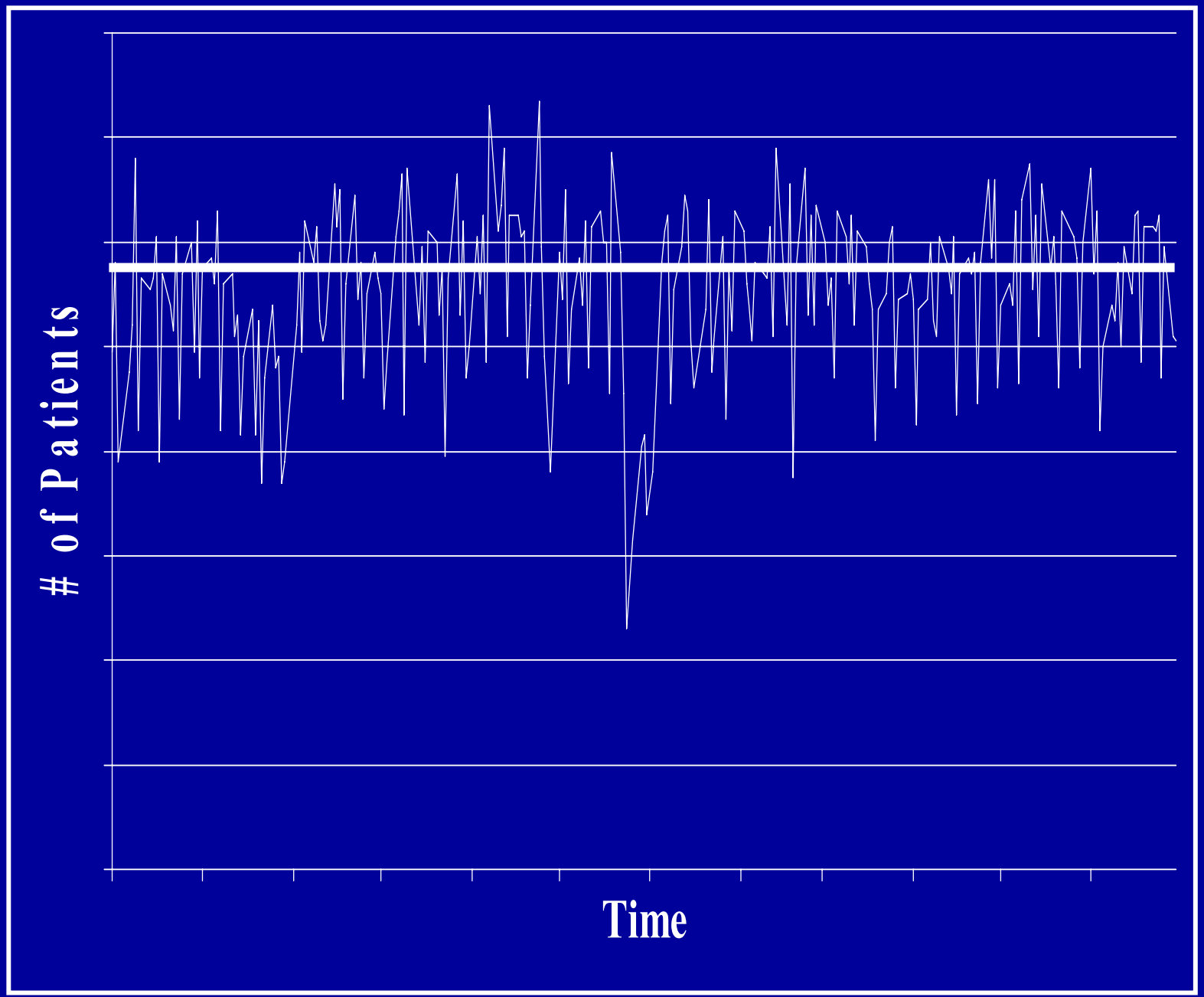
Reason's Swiss Cheese Model of Error



“Hard work and good intentions are necessary but insufficient for exceptional care”.

“Every System is perfectly designed to get exactly the results that it gets.”


# of Patients
Time

Variability

1. **“Natural”: you can’t control it …you just have to manage it. (e.g.. sick patients coming to the ED). Tool to manage it: queuing theory**

2. **“Artificial”: you can control it….you must eliminate it to create flow. (batching) (e.g. elective surgery scheduling, reading stress tests)**

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When we “batch and push” we create artificial peak loads that create overcrowding

- Internal Diversion –patients sent to alternative floors\Intensive Care locations
- Internal Delays – PACU backs up
- External Diversion - ED diversion; inability to accept transfers
- Staff overload – increased errors and staff unhappiness
- System Gridlock – Increase in LOS
- Decreased Volume
- Unhappy patients

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What business model should we use to improve flow?
Performance Improvement

1. **Focus on the patient and his or her family**
2. **Deep Process knowledge (*Design*)**
3. **Decisions driven by data**
4. **Teamwork**
5. **Empowerment**

"How can we use the ideas of individuals on the team to redesign our systems to measurably improve the health and satisfaction of our patients and their families while driving out waste?"

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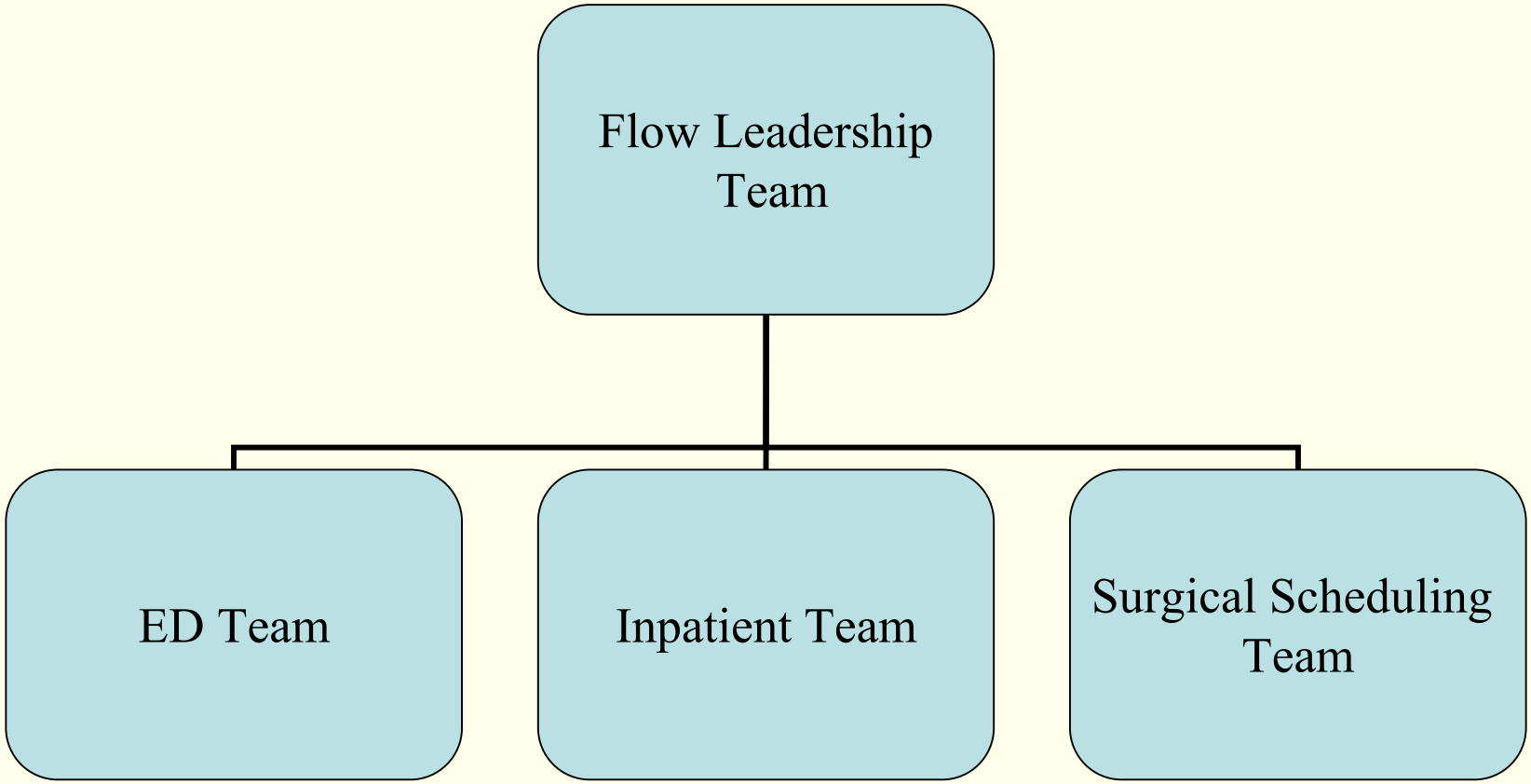
INPUT
Demographics
Health Status
Insurance Status
Availability of Alternatives
Perceptions of Quality
Emergency Department
THROUGHPUT
Triage, Registration Processes
Care Processes
Staffing
Specialist Availability
Diagnostic Services Availability
IT Systems
Death
Hospital Admission
OUTPUT
OR/ICU/CCU/MedSurg Capacity
Bed availability/tracking
ED/Floor interaction
Transport Services
Community Discharge
OUTPUT
Availability of post-acute care, community mental health, other services, primary and specialty care

Flow Teams at Boston Medical Center



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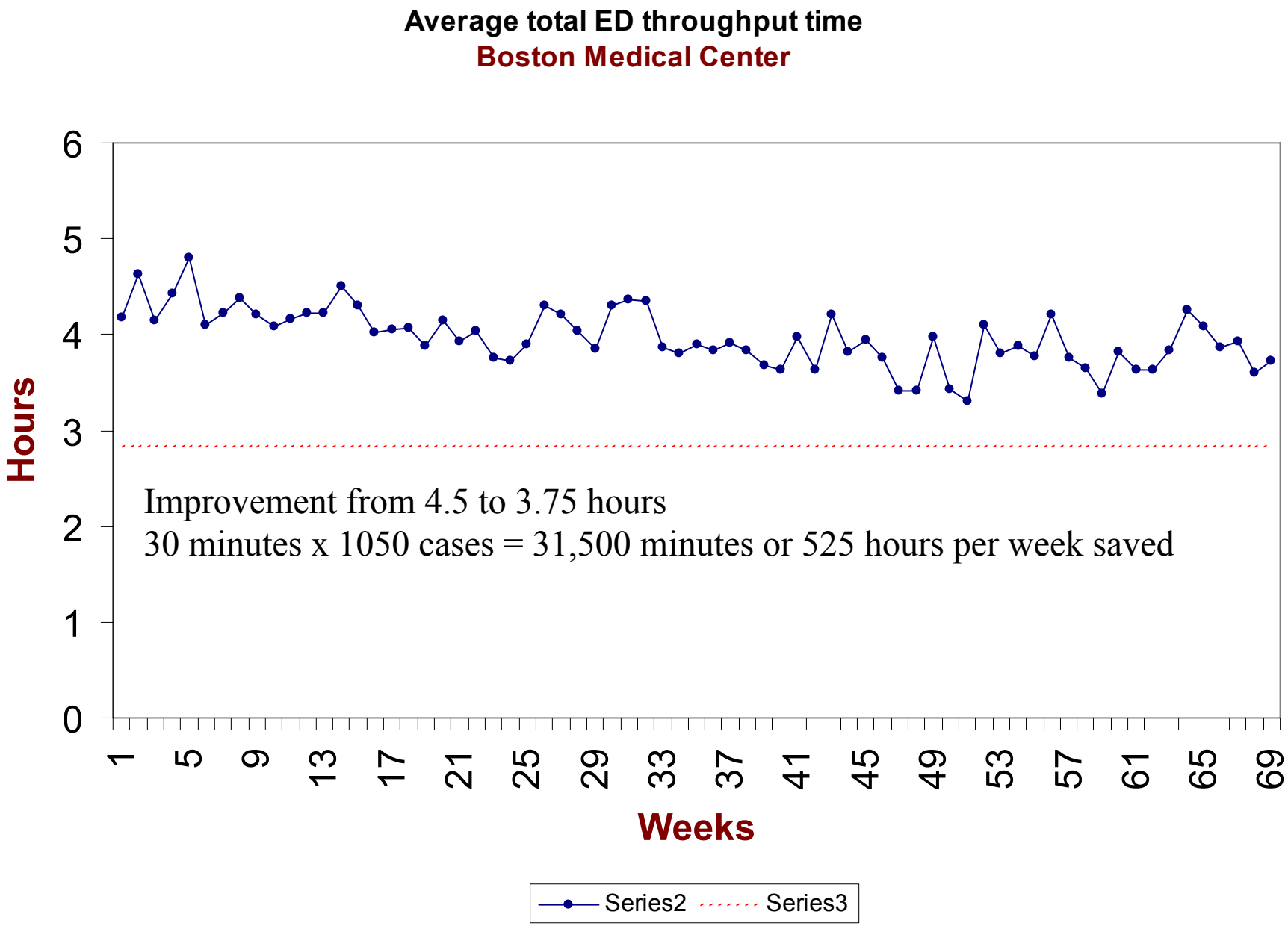
Average total ED throughput time
Boston Medical Center
Hours
6
5
4
3
2
1
0
1
5
9
13
17
21
25
29
33
37
41
45
49
53
57
61
65
69
Weeks
Improvement from 4.5 to 3.75 hours
30 minutes x 1050 cases = 31,500 minutes or 525 hours per week saved
Series2
Series3

Improving Inpatient Flow Team

- Janet Gorman
- John Chessare
- Linda Guy
- Jane Damata
- Dina Brauneis
- Brian Brisbois
- Sue Doherty
- Jacque O'Shea
- Cil Weekes
- David Roney
- Kim Wood

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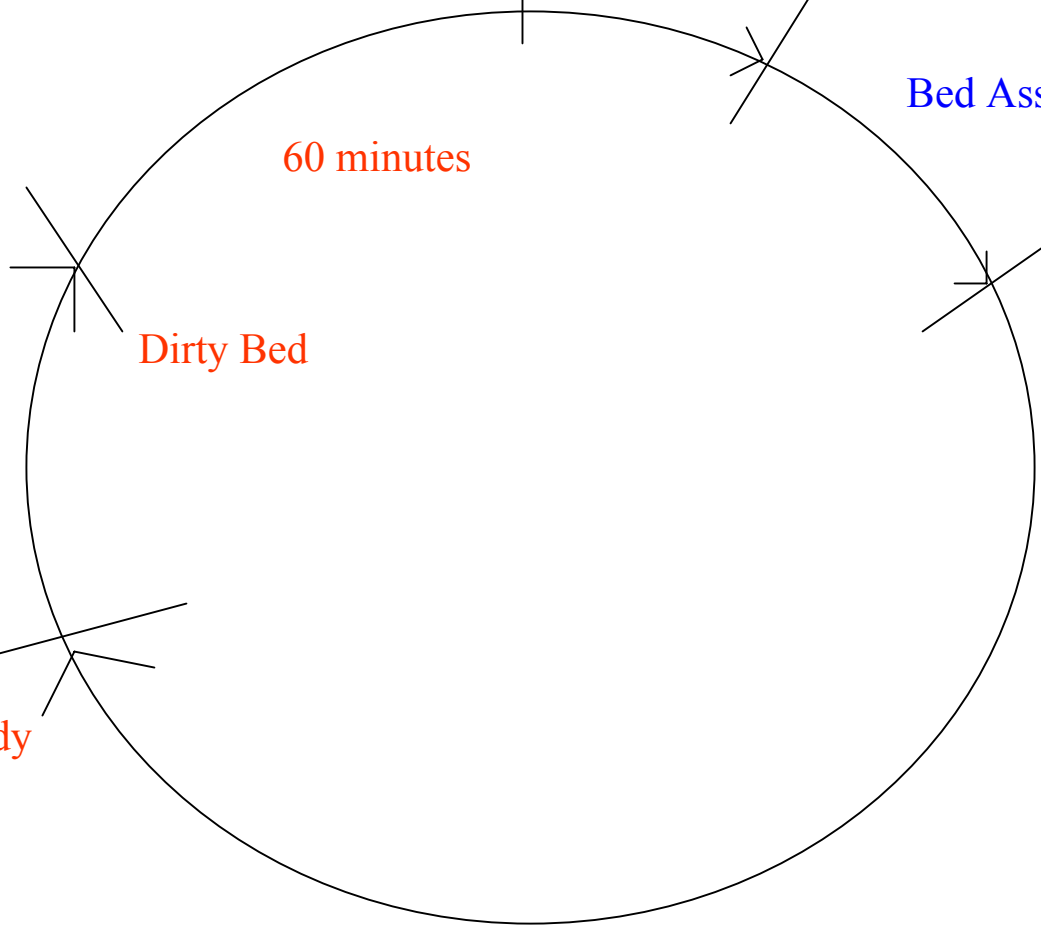
The Inpatient Cycle, Key Points, Key Process Indicators



Clean Bed

Bed Assigned

120 minutes

Bed Assignment to Arrival Time

Patient Arrives In Bed

5.5 days

Length of Stay

Patient Clinically Ready to Leave

Average Discharge Time

15:01

Dirty Bed

Patient Leaves

60 minutes

Bed Turnover Time

Maximizing Throughput:Smoothing the Elective Surgery Schedule to Improve Patient Flow

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Keith P. Lewis, MD
John B. Chessare, MD, MPH
Eugene Litvak, PhD

Richard J. Shemin, MD
Gail Spinale, RN
Demetra Ouellette
Abbot Cooper

Surgical Smoothing

1. **Smoothing Elective Vascular Surgery**
2. **Smoothing Elective Cardiac Surgery**
3. **Separating Elective From Urgent Surgery in the Menino Pavilion**
   - Creating reliable urgency data
   - Separating a room for urgent/emergent cases
   - Eliminating Block Scheduling

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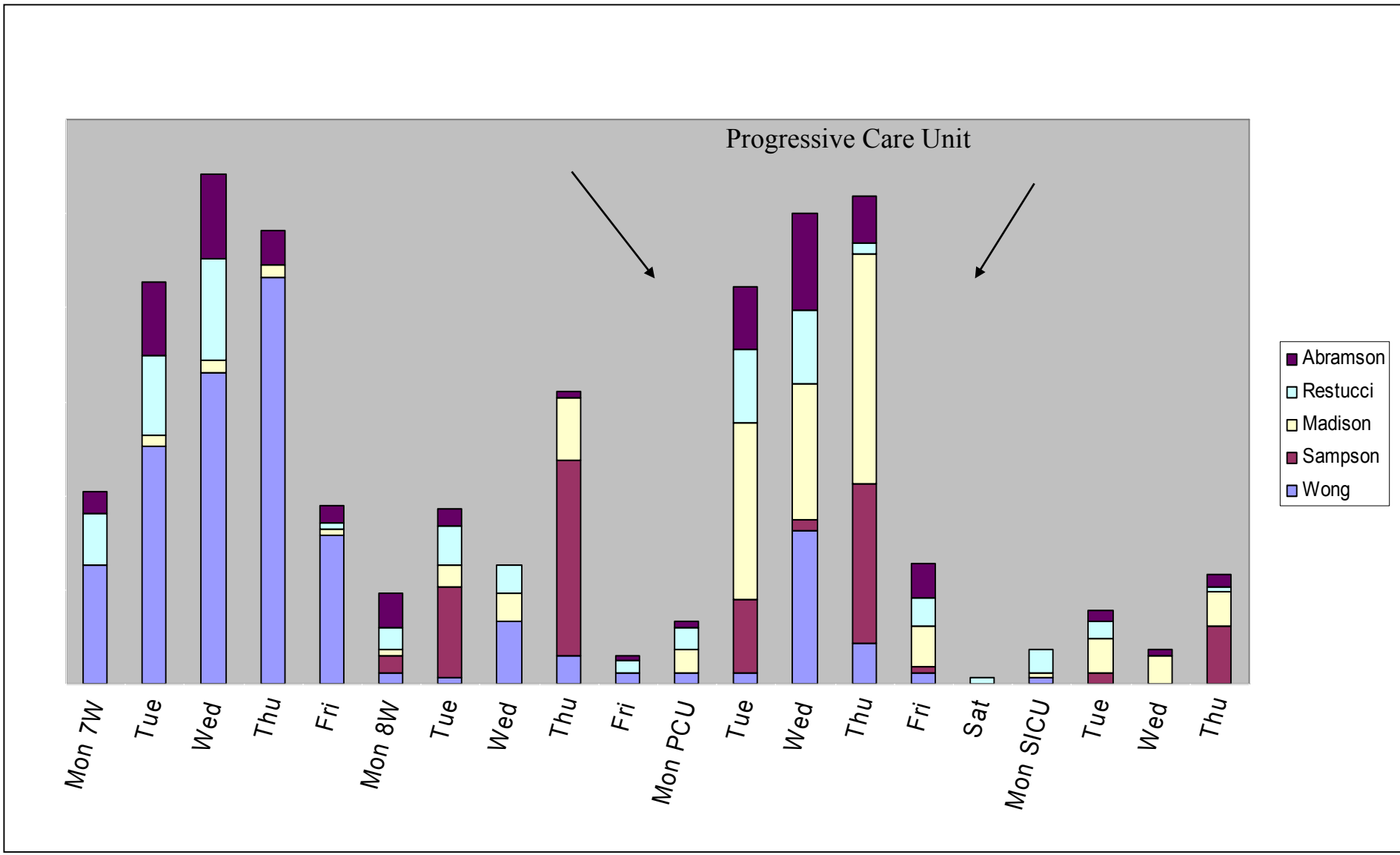
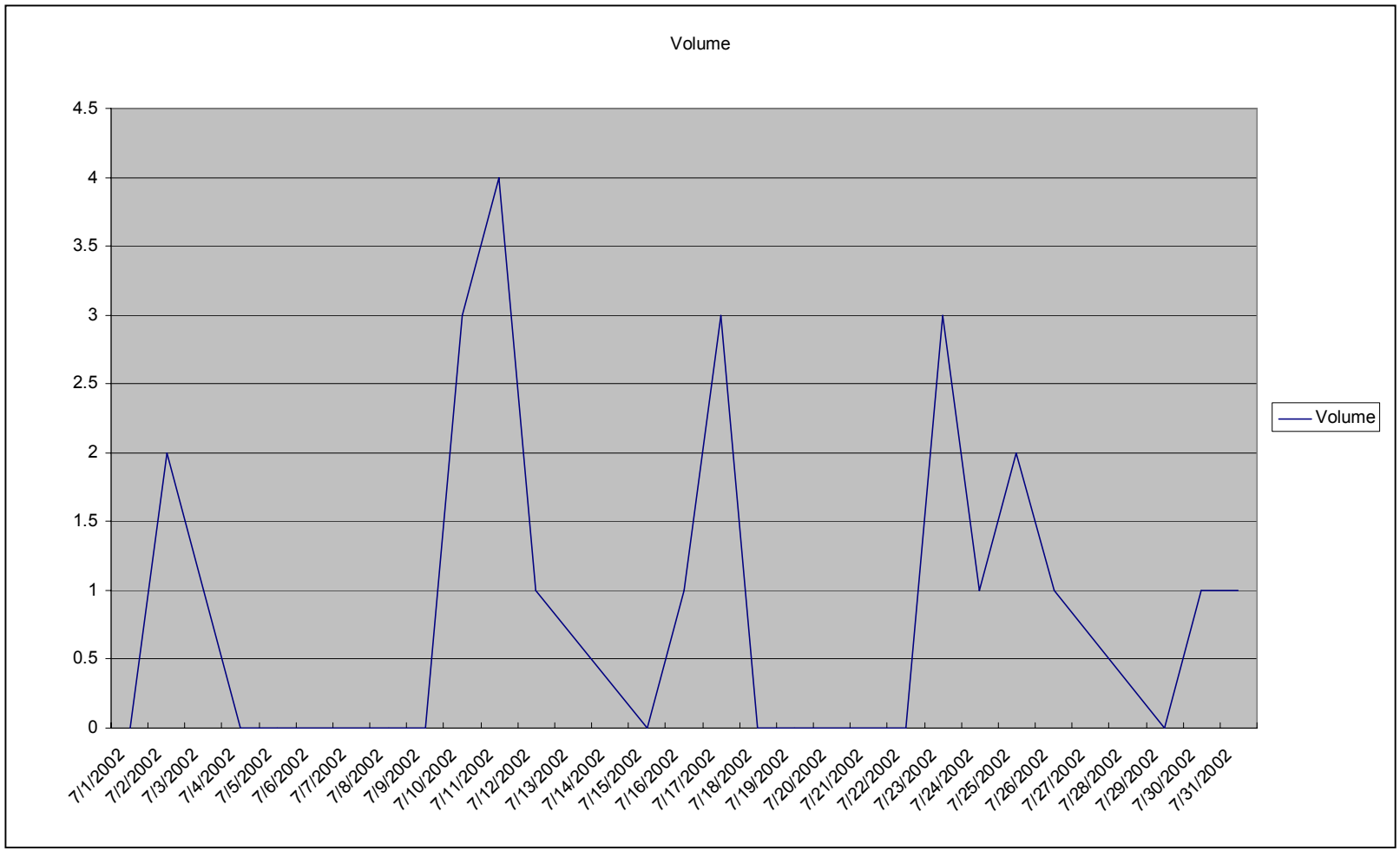
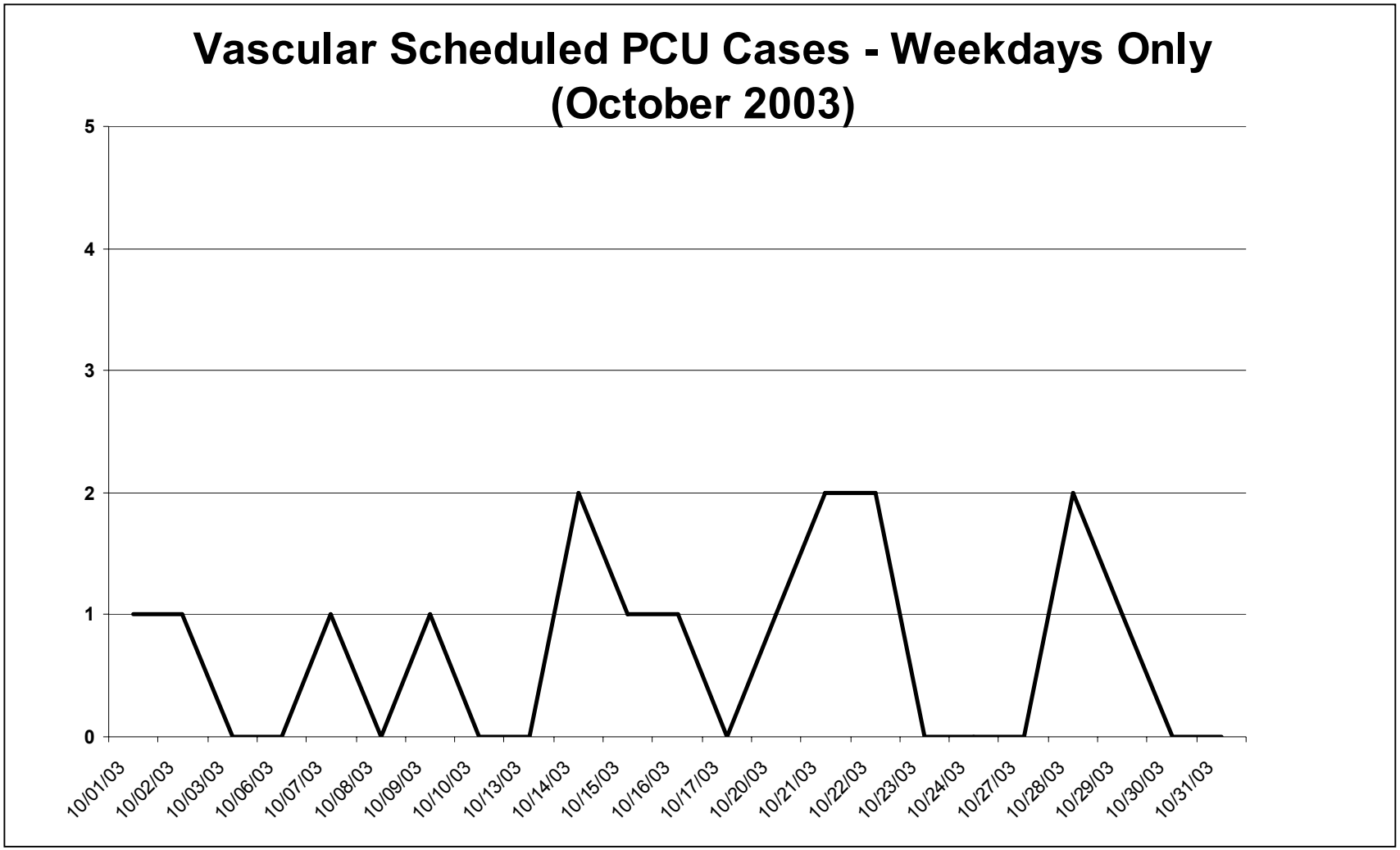
Bed Need by Day of Week for Vascular Surgery (18 months of data)



Vascular Elective PCU Cases by Day
Random Month July 2002




Vascular Scheduled PCU Cases - Weekdays Only
(October 2003)
5
4
3
2
1
0
10/01/03
10/02/03
10/03/03
10/06/03
10/07/03
10/08/03
10/09/03
10/10/03
10/13/03
10/14/03
10/15/03
10/16/03
10/17/03
10/20/03
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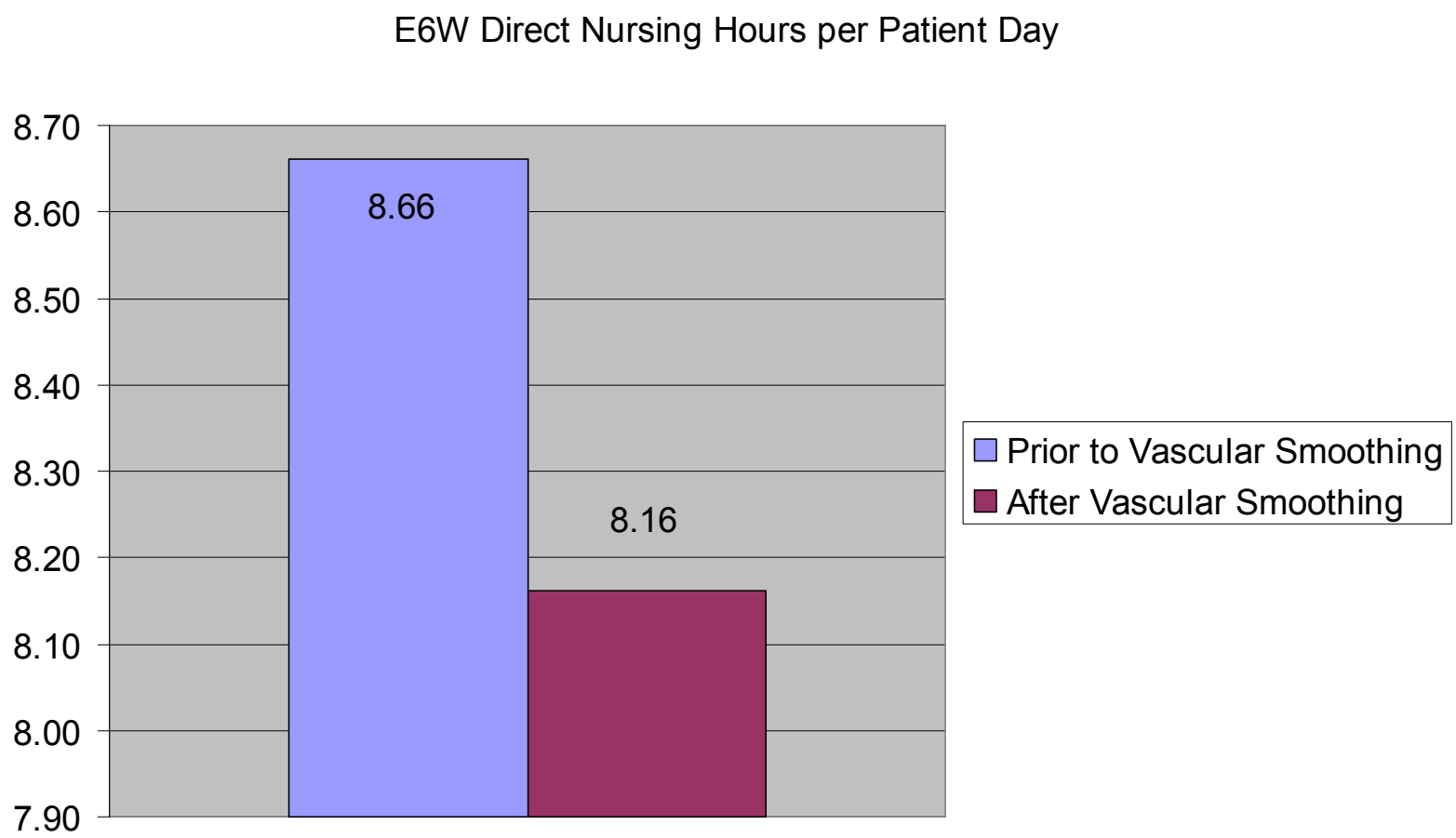
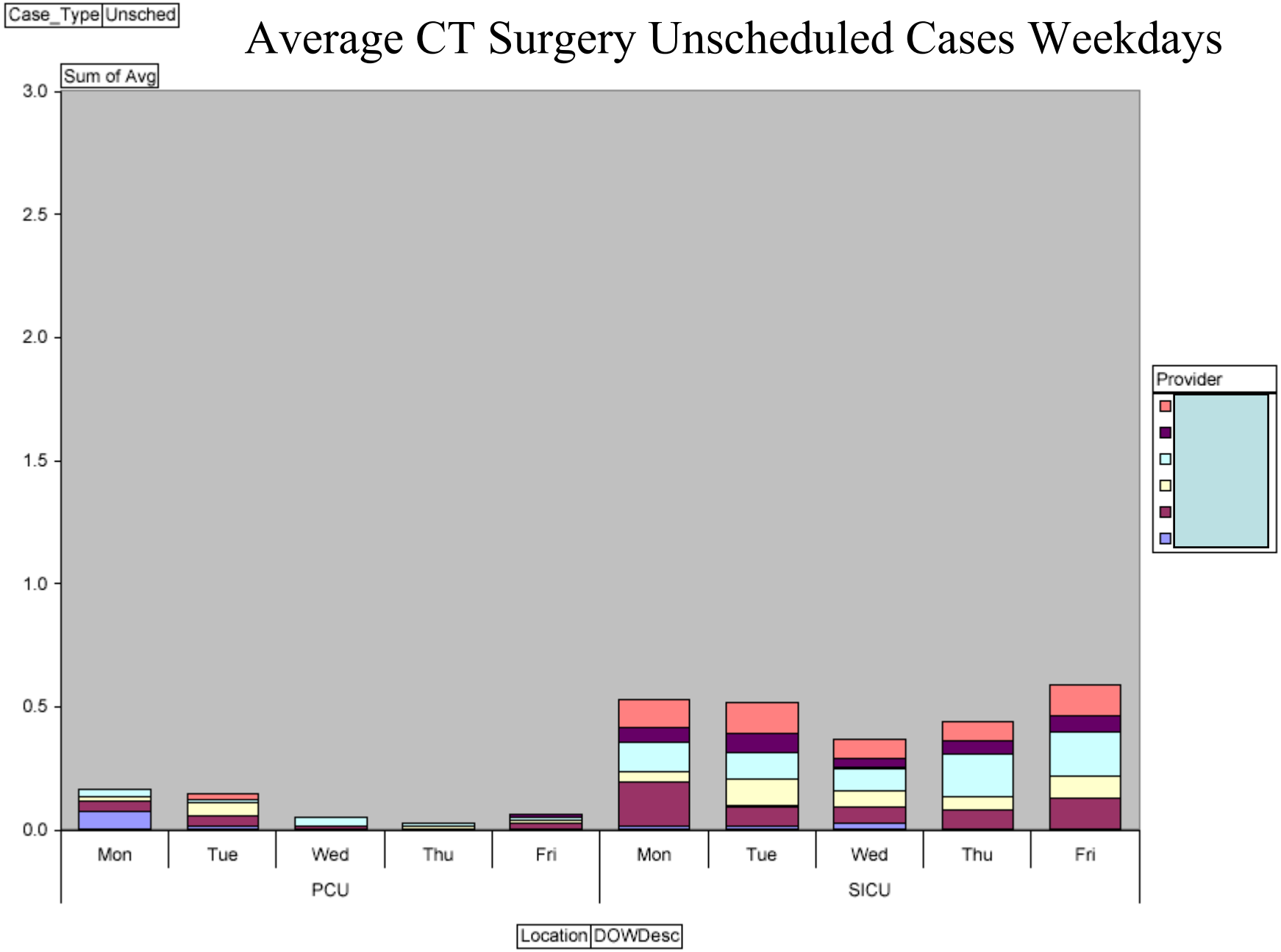
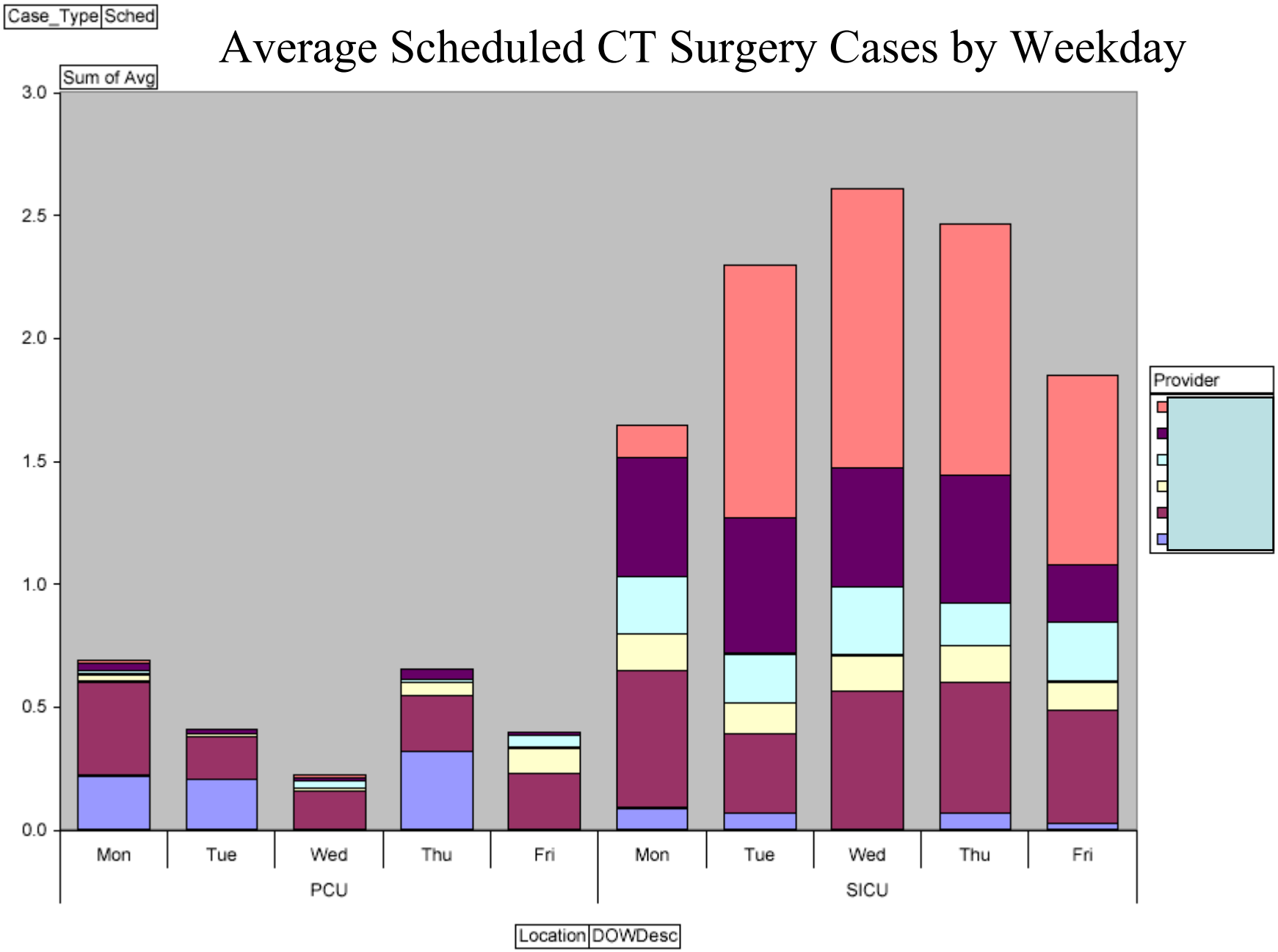
10/28/03
10/29/03
10/30/03
10/31/03

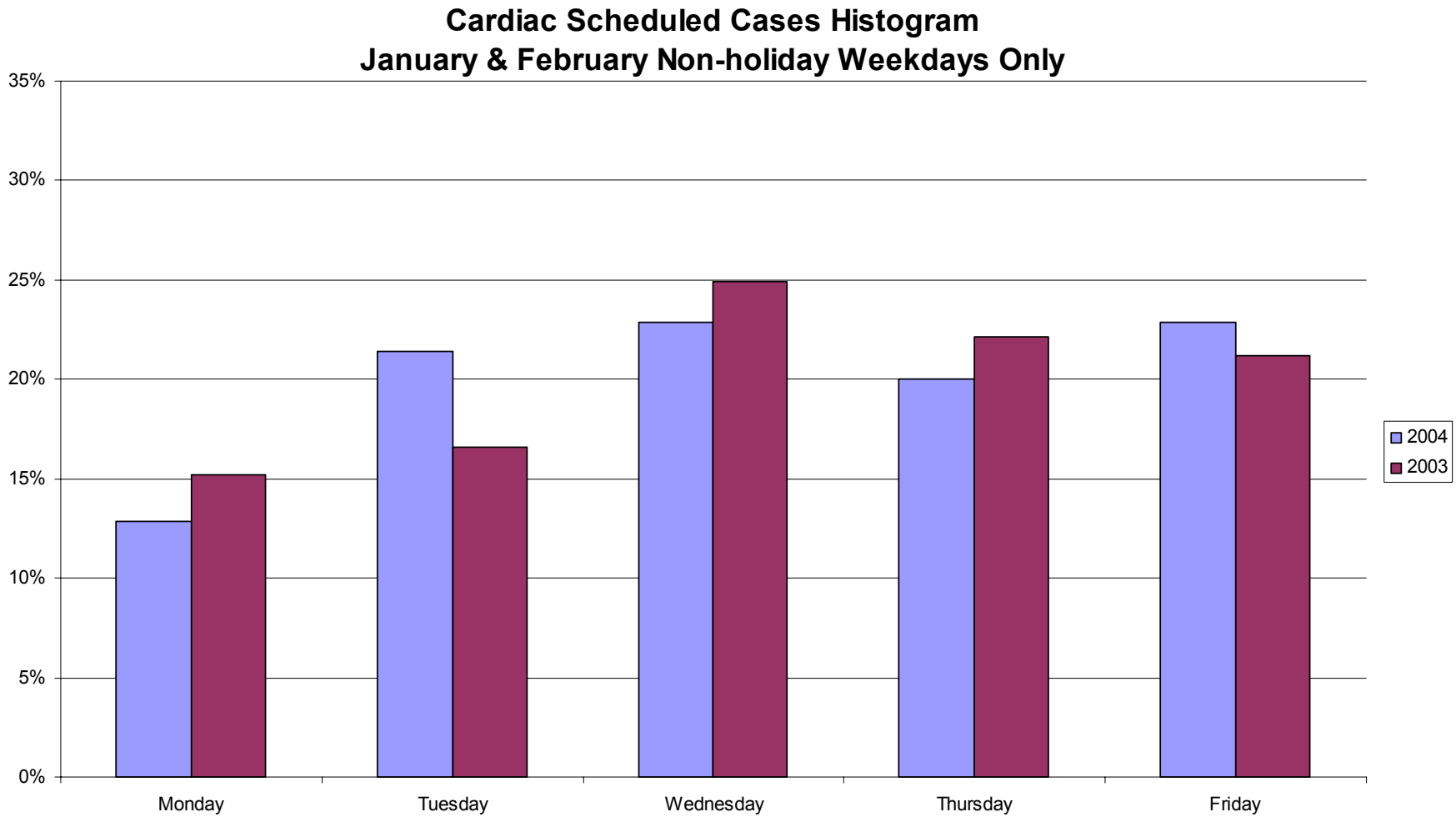

E6W Direct Nursing Hours per Patient Day
8.70
8.60
8.50
8.40
8.30
8.20
8.10
8.00
7.90
8.66
8.16
Prior to Vascular Smoothing
After Vascular Smoothing

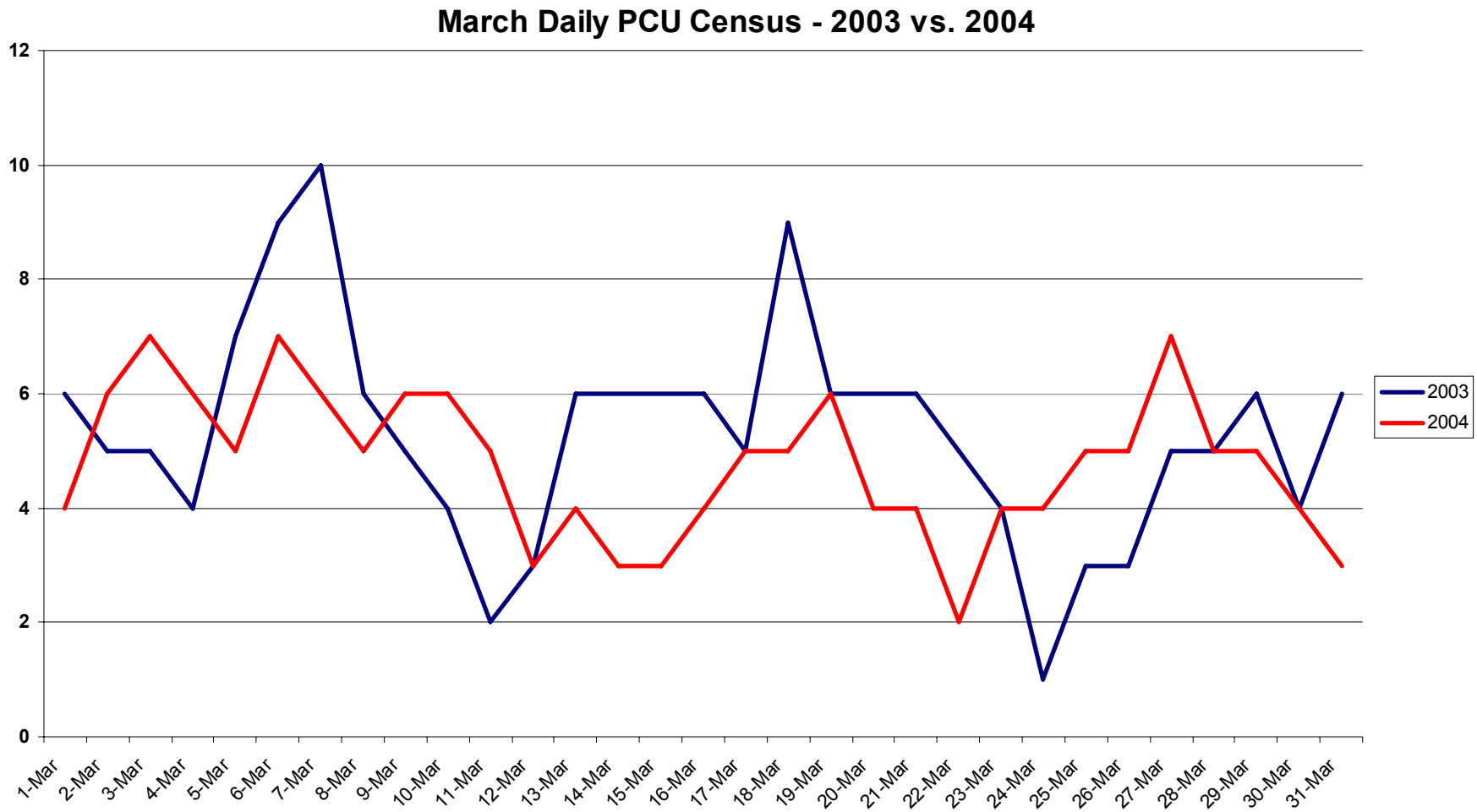
Average CT Surgery Unscheduled Cases Weekdays



Average Scheduled CT Surgery Cases by Weekday




Cardiac Scheduled Cases Histogram
January & February Non-holiday Weekdays Only
35%
30%
25%
20%
15%
10%
5%
0%
Monday
Tuesday
Wednesday
Thursday
Friday
2004
2003



2003 range 10 – 1 = 9

2004 range 7 –2 = 5

55% reduction in variability

Operating Outside of the Block at BMC

Separating the Flow of Elective Surgery from Urgent/Emergent Surgery

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Menino Pavilion compared to Newton Pavilion

Variable	NP	MP
# Rooms	13	8
# Cases Day	30-35	25-32
# Cases Year	8601	6608
Cancellation Rate	10%	20%
#Add Ons Per Day	1-2	5-12
#Weekend Cases	0-4	5-20
Unique Services	Cardiac, Ophth	Pediatrics, Trauma, Gastric Bypass, OB

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Pre-change Problems with the Daily Schedule – Menino Pavilion

- Urgent/emergent bump elective cases
- Overall 50% block utilization
- Variable use of block (vacation,meetings)
- Most cases booked 3-4 days out
- 33% of daily schedule is “add ons”
- Variable release time between services
- Cases can be lost waiting
- People live in ***fear*** of losing their block

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The Radical Changes

#1
Eliminated Block Booking

#2
One Urgent Room Created

OR 5

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Bumped Cases Before and After Separating "Flows"

Before

April 03 – April 04

- 349 emergent cases (M – F) 7:00 AM to 3:30 PM
- 771 elective patients were delayed or cancelled

After

April 04 – April 05

- 354 emergent cases (M – F) 7:00 AM to 3:30 PM
- 7 elective patients were delayed or cancelled

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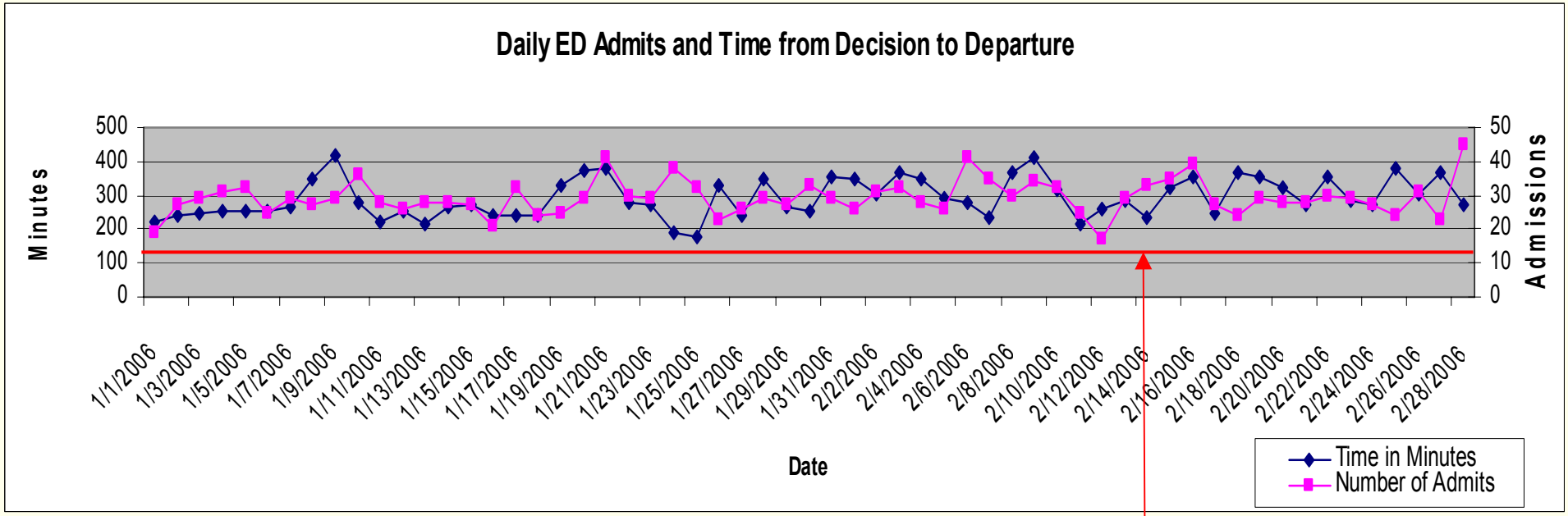
Norwood: Biggest Operational Dilemma



Goal = 120 minutes

Time

Range = 176 – 418 minutes (3 hours – 6 hours)

Mean = 300 minutes (5 hours)

Number of ED Admits

Range = 23 – 45

Mean = 30

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What is the true constraint?
Physician workup in the ED.

Find it and *elevate* it.
Moved to the inpatient unit.

What is now the true constraint?
Floor not ready.

Find it and elevate it.
Create Transfer Time.

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Some other constraints

- **No transporter: included transport in synchronization and added transport capacity**

- **No nurse to staff an inpatient bed: stopped staffing to monthly historic mean; create prediction software based on historic natural variability and today's census for tomorrow**

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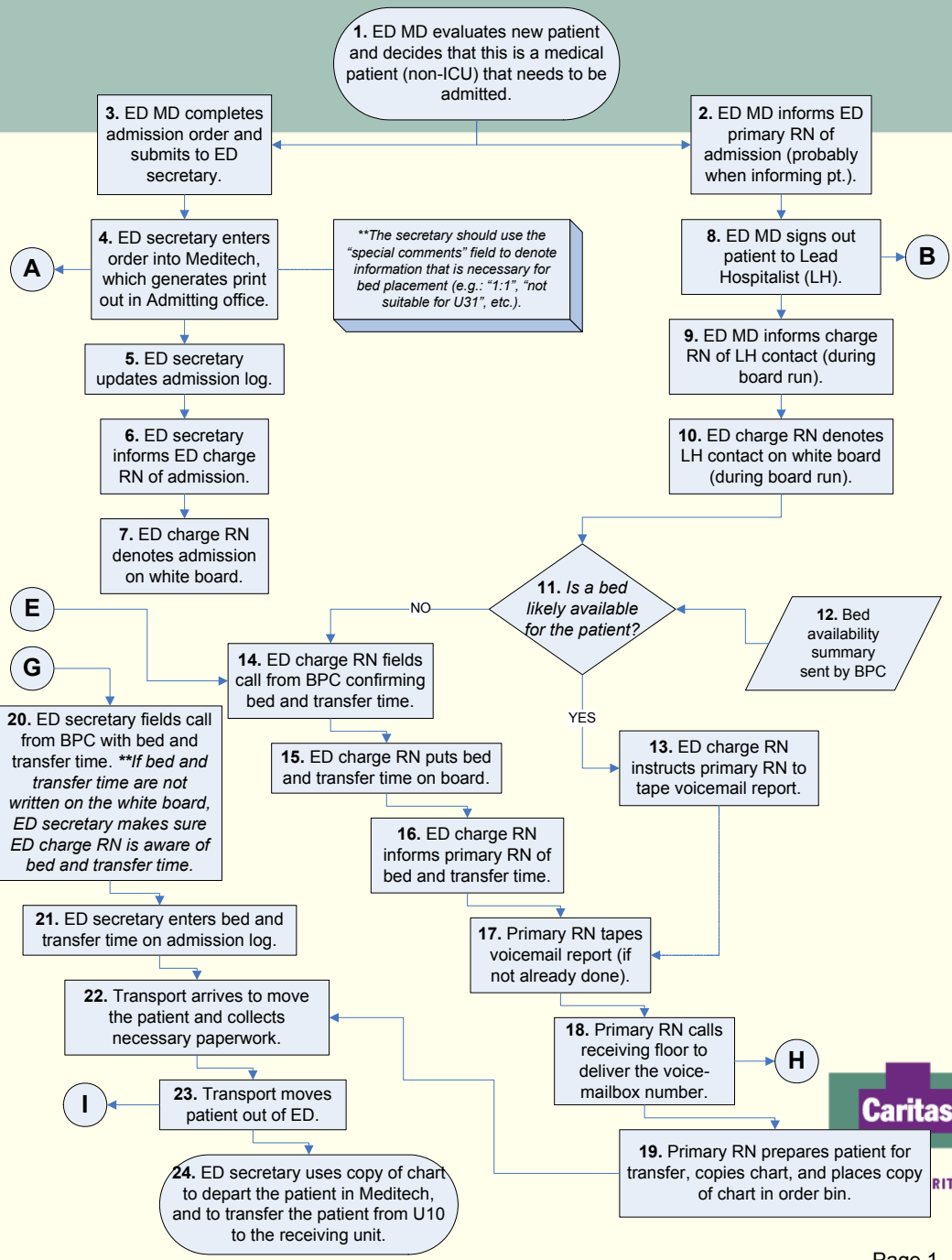
ED Medical Admissions Process: IN THE EMERGENCY DEPARTMENT...



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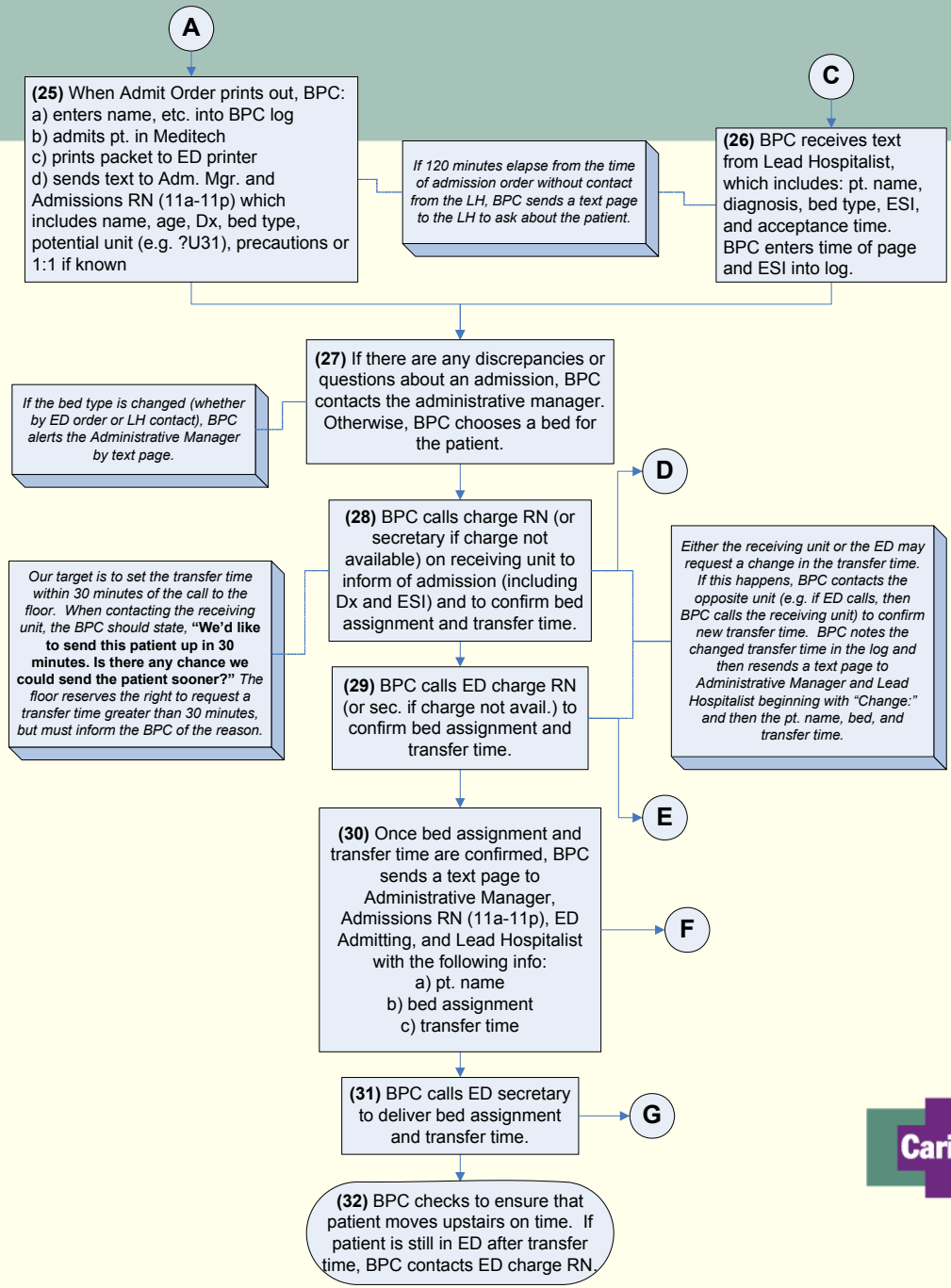
ED Medical Admissions Process: THE BED PLACEMENT COORDINATOR



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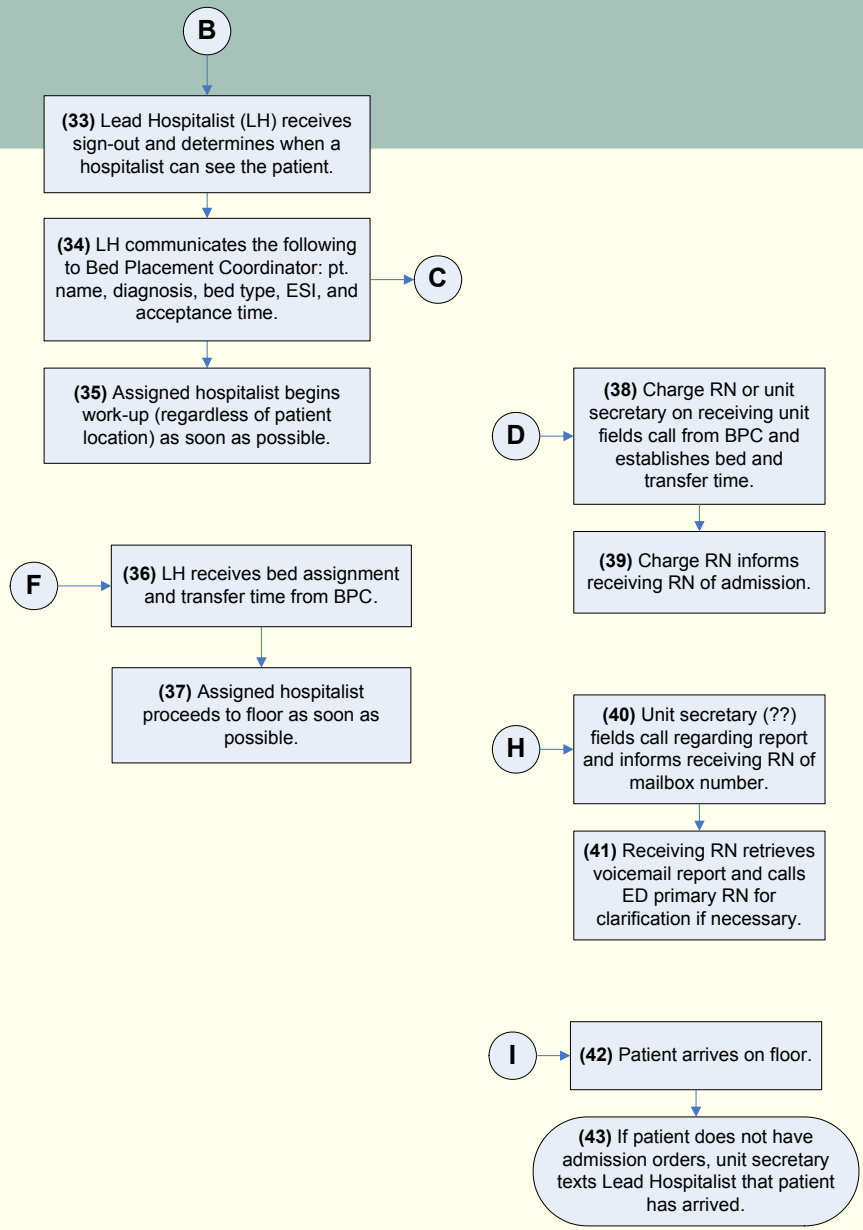

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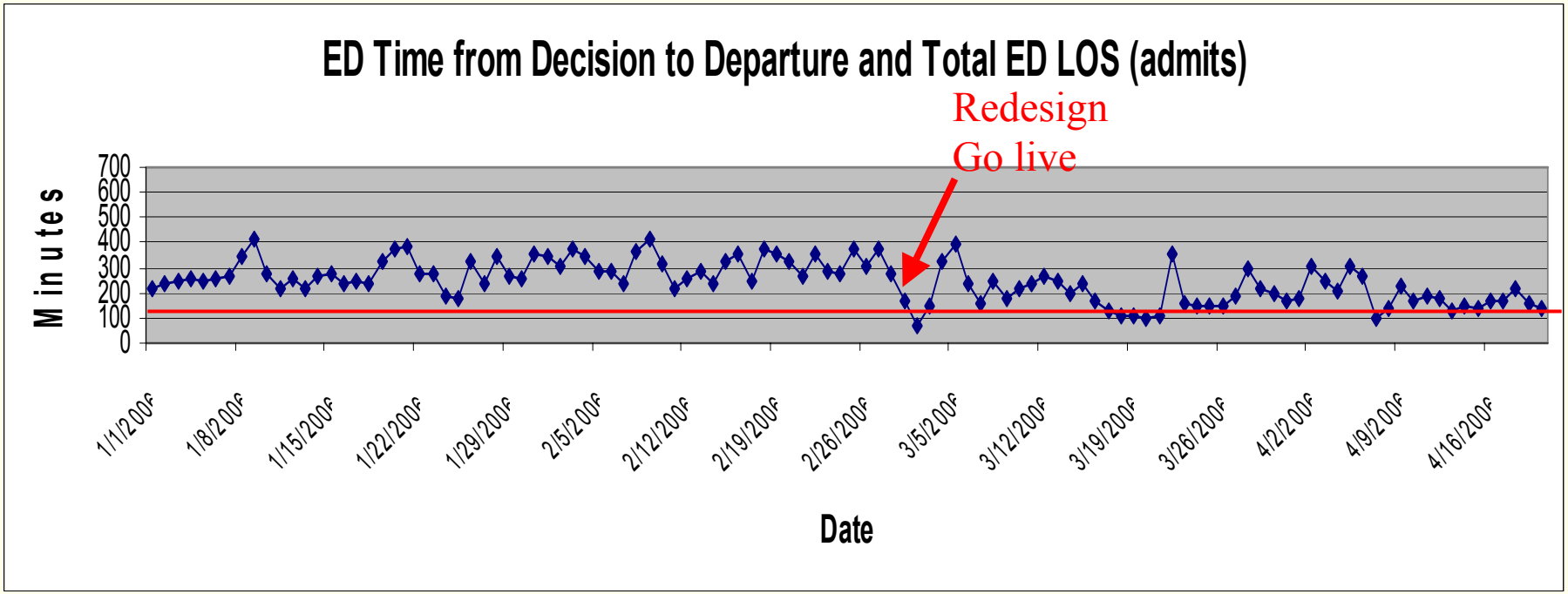

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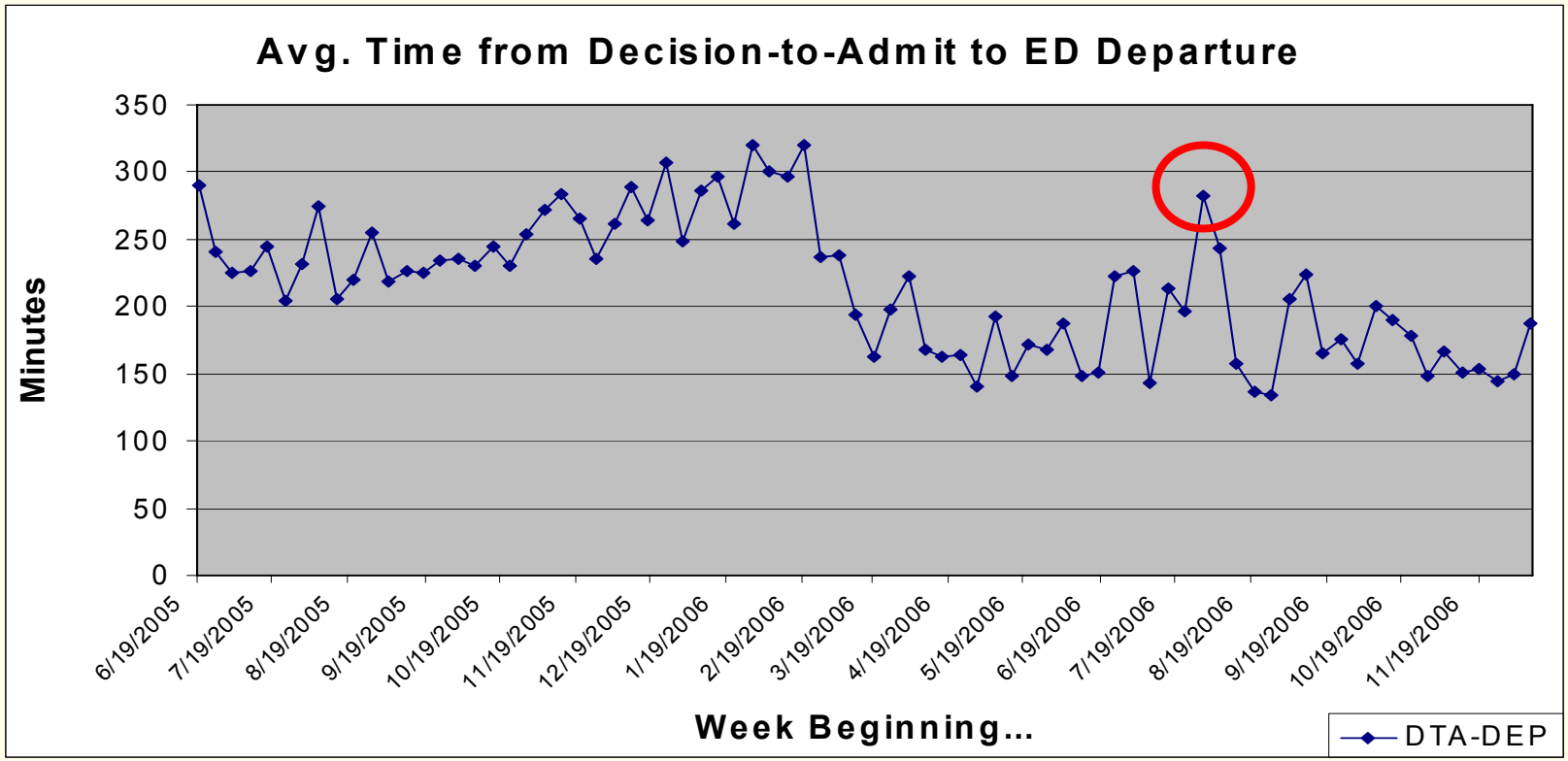
SERVICE

Reduce the average time from ED admission decision to departure to inpatient unit to 120 minutes calculated monthly.



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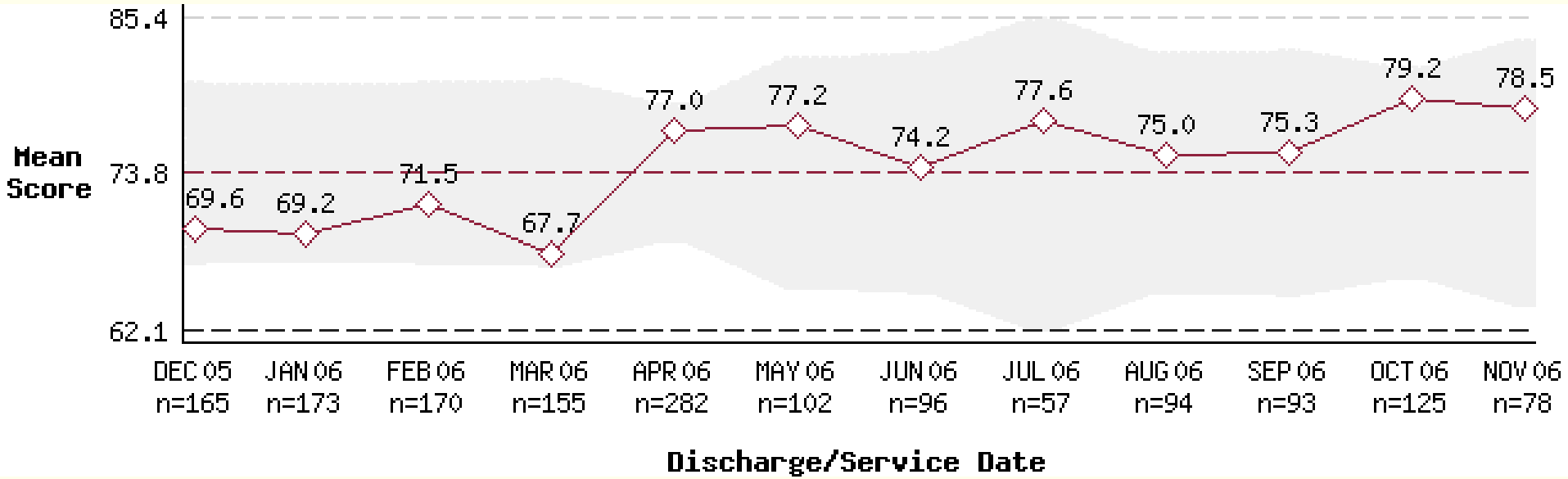
Question Mean Score: Speed of Admission



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Key change concepts of the Design

- Do tasks in parallel: move the patient to the floor while the workup continues
- Synchronize: assign a transfer to floor time (creates pull) after communication with charge nurses and hospitalist
- Central command: all beds are assigned by the nursing supervisor/bed facilitator
- Direct Communication: ED physician hands-off to Hospitalist
- Predict Demand: Use data on natural variability to get ready for staffing changes

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Summary

- There is much artificial variability in healthcare. We can no longer afford this waste.
- We must redesign our systems to maximize flow which will ***make our patients safer***, improve volume, staff and patient satisfaction and reduce the waste.
- Separating the flow of urgent surgery from scheduled surgery reduces waste and rework.
- No-Block scheduling is a good way to help the surgeons, patients, and staff.
- All hospitals should map inpatient flow and test changes to improve it.

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