

## **M1: Taming the Tail of the Dragon: Our Experience in Acute Care Flow**



### **Flow Dynamics**

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### **Flow as a System**

- ◆ Flow is a property of the entire system and can only be optimized at the system level
- ◆ Many unit/department attempts to optimize their flow often result in sub-optimizing other areas and system flow

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### The Myth of One-Hundred Percent Utilization

- ◆ Increasing average occupancy levels leaves less room for unscheduled admissions.
- ◆ Emergency admissions must be diverted, denied, or queued.
- ◆ Eventually, quality of care declines as *all* patients are increasingly placed into holding patterns:
  - ◆ New admissions managed “off service”
  - ◆ More “boarders” in the ED or PACU
  - ◆ Delayed elective medical or surgical admission.



### Artificial Variability

- ◆ Non-random
- ◆ Non-predictable (driven by unknown individual priorities)
- ◆ Should not be managed, must be identified and eliminated.

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### Natural Variability

- ◆ Clinical Variability
- ◆ Professional Variability
- ◆ Flow Variability

*Characterized by:*

*Being random*

*Cannot be eliminated*

*Must be optimally managed using queuing theory*

Eugene Litvak, PhD, Boston University

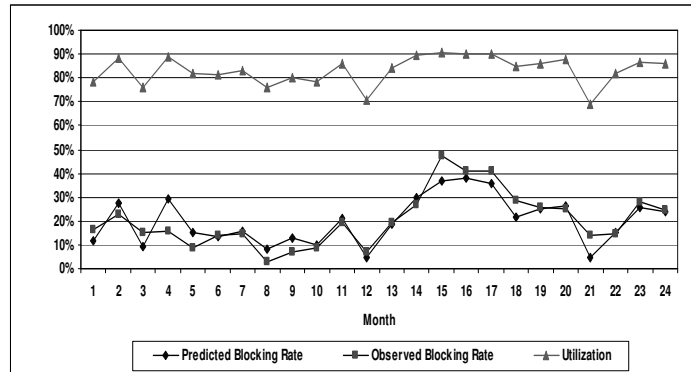
### Lessons from Queuing Theory: Background

- ◆ A descriptive modeling tool
  - ◆ Describes steady-state functioning of systems involving waiting lines
  - ◆ Mathematics dependent upon the variability of arrival and service rates
- ◆ Three variables define the system
  - ◆ Arrival rate
  - ◆ Service time
  - ◆ Number of servers

Michael McManus, Boston Children's Hospital, 2001

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Amidst variable inflow, how crowded can hospital units be?



As random demand meets a fixed capacity, rejections are accurately predicted by queueing theory ( $r = 0.9$ ).

Michael McManus, PhD



## Flow 'Buckets' of Work

- ◆ 'Seeing' flow: Establishing an administrative system
- ◆ Diagnosing flow problems
- ◆ Synchronizing work and goals: MDR
- ◆ Smoothing elective admissions
- ◆ Synchronizing admissions, discharges and transfers
- ◆ Extending the chain

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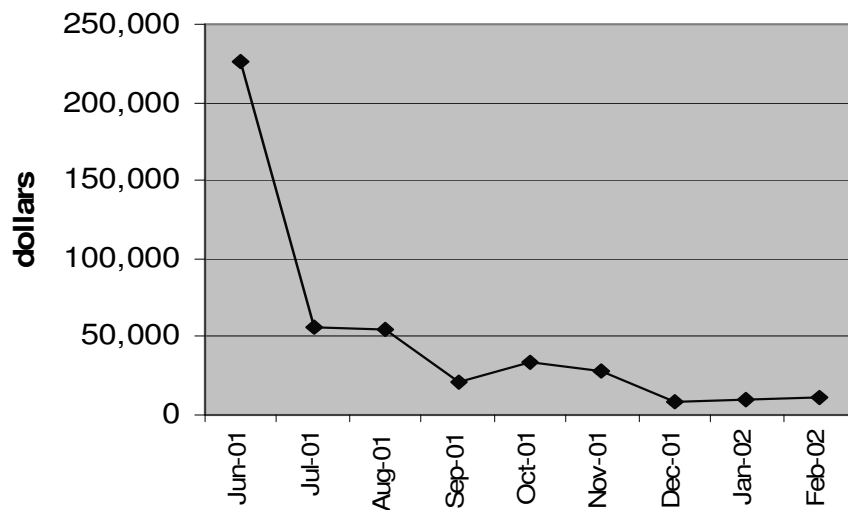
### Quality of care affects flow dramatically

#### ICU Days and Adverse Events

- ◆ Nationwide study of a “trigger tool” for adverse events in ICU(IHI VHA)
- ◆ Approximately 2 adverse events/ICU day
- ◆ In dept evaluation of 25 consecutive events showed 54 extra ICU days
- ◆ (Flow in the ICU means reducing adverse events in the ICU)

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#### Net dollars lost to diversions



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### **The Consequences When Flow Isn't Flowing...**

- ◆ **Clinical:** patients placed off service, patients boarded, clinical decisions can be delayed
- ◆ **Workforce:** staying late, caring for off-service patients
- ◆ **Financial:** money lose to un-reimbursed days, diversions, cancelled or delayed surgeries