The Emergency Department as a Complex System

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Emergency Department as a Simple System

All complex systems are simple at a high level

- Patients enter a room with a condition
- Patients then leave the room having been discharged or referred

The department functions as a small hospital

- All steps a patient goes through in a hospital are performed quickly and efficiently at a small scale
- Paths internally are different for all patients

Measures of Success

Score High in some categories

- Satisfaction, outcomes, patient volume, income, etc.

Score Low in others

- Turnaround time, costs, etc.

This information is all relatively accessible and easy to measure, making judging the effectiveness of an emergency department relatively easy.

Emergency Department Management

Three tiers of management

- Physician - patient level
  - Most direct implementation of the goals of the department
- Physician - Physician level
  - Higher-up management, where action in concert must be maintained and taks distributed
- Director level
  - Top level of immediately-accessible management of all tasks, not just those directly associated with patients

Emergency Department as a Complex System

Four separate sources of complexity

- The Patients
  - All patients affect the process differently.
  - If a patient needs different care, everything needs to change to accommodate
  - All patients need to be monitored for changing circumstances
- The Physicians
  - Act as complex systems on their own.
  - All members need to manage their surroundings and adapt to new scenarios
  - Time-sensitive info may appear and causes immediate changes

Emergency Department as a Complex System

Four separate sources of complexity

- Any Decisions made
  - Many decisions and changes cause shifts
  - Decisions must be made without full information
  - Decision trees are difficult to make algorithms for
- The Environment as a whole
  - Most Emergency Departments are in small spaces
  - Patients can enter at any time

Existence at the Edge of Chaos

- Anything can happen at any time
  - All people need to immediately adapt to strange circumstances
  - The state can shift from busy to not and back very quickly
- A situation can either be “resonant” or chaotic
  - Many factors affect the current state
  - It isn’t clear how to move toward the former
- Every scenario can find itself in a chaotic state
  - “Disaster mode”

Effecting Change in Complex Systems

- Complex systems are very difficult to change or analyze
- 85/15% rule
  - The most of a system you can affect at a time is 15%
  - The other 85% will not cooperate as the system is to complex to manage in a reasonable manner
- Direct approaches usually fail with people
- “Top 10 days”
  - ED tracked patient throughput turning high volume days into a sort of game

Building a Complex System

- Simplify processes
  - Use fewer steps
  - Use fewer people
- Fewer transfers of information
- Adding a mini blood lab into the ED greatly reduced turnarounds

Local Feedback Loops

- If we only transmit direction one way we end up with a game of telephone
- Verify that information is correct
- A situation related to this occurs in billing in the ED
  - ADT register patient
  - Chart is generated by nurses and physicians
  - Coders extract bills
  - These bills are then passed to insurance

Management by principle rule and aphorism

- Memes
  - 80/20
  - 15%
  - Avoid Overdesign
  - Seek Min-Specs
  - Permit Self-Organization
  - Palpable synechdoche
  - Unintended consequences
  - Invest in People

Invest in people

- Hiring the best people pays off in the long run
- 10-20% increase in investment has high ROI
- Intelligent agents can self organize when given min-specs

85% 15%

- The biggest challenge in management
- Find the correct 15% to impact
- Determine how to change it
- It will affect the rest of the system
- Bed assignment can be difficult
  - Lots of interacting groups
  - Possible 15% - Make information visible

Future Work

- Use the ED to study complex systems
- Why can similar situations lead to different behaviors
- “Cure for chaos”

Questions?