Patient Flow Through a Hospital

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Introductory Information

- Industry information
- Establish and define the nodes
- Specify the paths
- Define the modes of travel on the network
 - flow through the hospital via urgent and nonurgent admissions
- Identify mode path usage differences
- Spotlight congestion

U.S. Hospital Traffic

- Hospital Inpatient Care for 2002
 - Number of discharges: 33.7 Million
 - Average stay: 4.9 days
- Emergency Department Visits for 2002
 - 110.2 Million
 - 22% seen within 15 minutes
 - Average wait = 3.2 Hours
 - 12% Result in Hospital Admission
 - 1% Directly to ICU/CCU

U.S. Healthcare Expenditures

2001 Expenditures: \$1.4 Trillion
14.1% of Gross Domestic Product

- Hospital Care: 32%
 - \$448 Billion
- Health Expenditures Using Public Funds
 - 45% or \$630 Billion

Assumptions

- We assume our facility has the technology to care for any patient, so we will not discharge from our hospital to one with higher technological functionality.
- Discharge means when someone leaves the care of the hospital, and is handled by individual departments, not by a single Discharge department.
- We assume no perishability on the network, so the demand on the links remains constant.
- We only included departments that admit and discharge patients.
- The following do not meet the above criteria: Radiology (x-ray, CAT scan, MRI), the Laboratory, or Radiological Therapies (i.e. for Cancer treatment, or Nuclear medicine).

Network Structure- Nodes Defined

- Admissions (Admit)
- Discharge (Disch), this is not a department
- Obstetrics (OB)
- Psychiatry (Pysch)
- Surgery (Surgery)
- Critical Care Unit (CCU)
- Medical Surgical Unit (Med/Surg)

Network Structure - Topology



Network Structure – Paths 1-6 of 12 dw= (Admission, Discharge)

P1= (a, c)

- Short term acute psychiatric care
- P2 = (b, d)
 - Uncomplicated birth
- P3 = (b, i, k, d)
 - Birth with Surgery
- P4 = (g, t)
 - Day Surgery, no over night stay

P5 = (f, m, p, q)

- Med/Surg to Surgery and back
- P6 = (f, l, n, q)
 - Med/Surg to CCU and back

Network Structure – Paths 6-12 of 12

dw= (Admission, Discharge)

P7 = (f, m, h, j, p, q)

Med/Surg to Surgery to CCU back to Med/Surg

P8 = (f, l, j, h, n, q)

Med/Surg to CCU to Surgery back to CCU to Med/Surg

P9 = (g, p, q)

- Surgery to Med/Surg
- P10 = (g, h, n, q)
 - Surgery to CCU to Med/Surg

P11 = (e, n, q)

CCU to Med/Surg

P12 = (e, j, h, n, q)

CCU to Surgery to CCU to Med/Surg

Modes Defined

 Mode 1 -- urgent admission (through the Emergency Department (ED))

 Mode 2 -- non-urgent admission (through the Admissions Department)

A Vital Mode Difference

Unused paths

- Unused in Mode 1 (Urgent)
 - Path 4 (day surgery)
- Unused in Mode 2 (Non-urgent)
 - Path 1 (acute psychiatric care)
 - Paths 9, 10 (imply urgent surgery)
 - Paths 11, 12 (imply sudden critical illness)

(note that non-urgent cases can become urgent after admission)

Unused in Mode 1 (Urgent)



Path 4

Unused Paths in Mode 2 (Non-Urgent)



Paths 1, 9, 10, 11, 12

What is the problem?

Congestion on the network leads to extended patient wait times and decreases network flow.

In the hospital that may mean waiting in the Emergency Department (ED) or CCU or Surgery for a bed in med/surg.

Why does this happen?

Some services are not interchangeable. E.g. Surgery and CCU

Variation in both patient flow and needs.

Different care requires different paths.

Where is the congestion?



Most used links and frequency

- q 8 (pts leaving through med/surg)
- f 4 (pts admitted to med/surg)
- h 4 (Surgery to CCU)
- n 4 (CCU to med/surg)
- g 3 (admitted directly to surgery)
- j 3 (CCU to Surgery)
- b, d, e, l, m, and p, 2
- a, c, i, k, and t,

Most Used Links



Conclusions

- Heaviest demand on the network involves interaction between med/surg, CCU and Surgery.
- One method used to ease demand on link q (the med/surg floors) is establishment and use of day surgery. This bypasses links p and q (med/surg) completely. (Path 4 in our model).
- Methods to ease Emergency Department congestion have included increased evening hours by physicians and creation of urgent care clinics for evenings and weekends.



Center for Disease Control Statistics

- <u>http://www.cdc.gov/nchs/fastats/ervisits.htm</u>
- <u>http://www.cdc.gov/nchs/fastats/hexpense.htm</u>
- <u>http://www.cdc.gov/nchs/fastats/hospital.htm</u>
- Articles
 - Optimizing Patient Flow
 - <u>http://www.ihi.org/IHI/Products/WhitePapers/OptimizingPatientFlowMovingPatientsSmoothlyThroughAcuteCareSettings.htm</u>