Providing Timely Access to Healthcare
or
Must Patients be Patient?

Based on presentation by

Professor Linda Green

Columbia Business School

April 20th, 2007
College Park, MD

Introduction

- Healthcare is riddled with delays
- Patients wait for hours in the emergency room (ER) before seeing a physician or getting a bed
- Inpatients wait days and outpatients wait weeks for diagnostic imaging
- Patients wait weeks or months for an appointment with their physicians
- Inpatients often don’t get medications when they should and experience long waits for nursing care

Consequences for Patients

- ER delays are correlated with mortality
- ER delays are correlated with the fraction of patients who leave without being seen (LWBS)
  - In a recent study, up to 11% of patients who LWBS need to be hospitalized within a week
  - About 46% were judged to require immediate medical attention
- ER overcrowding results in ambulance diversions
  - Glied, Green, and Grams (2005) found a correlation between diversions and deaths

Trauma in the ER

- Article in The Hartford Courant, 9/20/06
  - The death of a woman from a heart attack after waiting two hours to be seen in an Illinois emergency room last week didn't surprise emergency room physicians in Connecticut

Challenges in the ER

- ERs are often understaffed
- Causes
  - Costs
  - Shortages, absenteeism
- Arrivals to the ER have strong time-of-day and day-of-week patterns, making good staffing decisions difficult
  - Data on demands and delays are rarely collected or analyzed
  - Staffing is done by intuition

Arrival Patterns to ER

- Volume low from 3 am to 7 am
- Increasing from 7 am to noon
- High from noon to 8 pm
- Decreasing from 8 pm to 3 am
- True for visits due to injury and to illness
- Higher volume on Mondays and Tuesdays than on Saturdays and Sundays
- At one NY ER, 8.3% left without being seen

Using Queueing Theory to Improve Staffing

- See papers by Green, Kolesar, and Soares (2001, 2003) for details
- Queueing theory is used to reconfigure the staffing of Physicians in the ER to better match supply and demand
- Results for a NY Hospital (Allen Pavilion) ER are provided next

Queueing Theory to the Rescue

	Oct 2002 – May 2003	Oct 2003 – May 2004
Total visits	14,501	15,990 7.3% increase
Patients LWBS (%)	8.2	6.5 13% Reduction
ER LOS (hrs.)	4.8	4.5

Notes: LWBS = leave without being seen

LOS = length of stay

Another Source of Delay: Diagnostic Imaging

- Diagnostic imaging or MRI has become very popular
- The equipment is expensive (> $4 million)
- The use of these machines is tightly regulated
- The usual operating objective is full (100%) utilization

Demand for MRI

- Emergency patients
  - They arrive randomly, have highest priority
- Outpatients
  - They are scheduled, there are cancellations
  - They pay a fee-for-service
- Inpatients
  - Demand is random, no incremental fee

Decision Problem for the Hospital

- If there are both outpatients and inpatients waiting for access to an MRI, who should be served next?
- Emergency patients always have priority
- Green, Savin, and Wang (2006) gathered data at the Milstein Facility in NY
- Using dynamic programming, they determined that a near-optimal policy is “inpatients-first”

Inpatients-First

- The logic is as follows
  - If an inpatient is passed-over for MRI service today, he/she is likely to spend an extra day in the Hospital
  - This is typically more costly than the revenue (fee-for-service) generated from an outpatient
- This policy has been discovered and implemented at other Hospitals

Appointment Problems with Physicians

- The average wait for a medical appointment in 2001 was over 3 weeks
- Long waits lead to cancellations and no-shows → wasted physician capacity
- Many of these re-schedule for a later date
- The percentage of no-shows increases as does time till actual appointment

The Dynamics of Physician Practices

- Over time, utilization goes down while waiting time goes up
- Office staff and physicians spend more time on the phone dealing with patients trying to get earlier appointments
- In response, many physicians overbook which results in angry patients in the waiting room
- A common scheduling method is the “carve-out” approach

The Carve-Out Approach

- Many primary care offices divide patients into "urgent" and "non-urgent" groups
- The carve-out approach is used to ration service capacity between these groups
- Suppose 20 appointments are scheduled per day
- Maybe five are reserved for urgent patients and 15 are left for non-urgent appointments

Advanced Access: An Alternative to Carve-Out

- Leave the entire daily capacity open for all patients
- 15 appointments are reserved for all patients who arrive “today”
- Five appointments are reserved for “return” patients and those scheduled before “today”

Implementing Advanced Access is Not Easy

- For AA to succeed, physician capacity and patient demand should be in balance
- Physicians ask the question: What does this mean for my practice?
- Bottom line: Implementation of AA fails in about one of three cases

Panel Size

- A measure of the size of a physician's practice is the panel size N
- In single-physician care settings, N = # patients assigned
- In single-physician fee-for-service settings, N = # patients over last two years
- Two-thirds of all primary care physicians work in group practices
- In group practices, N = # patient requests for physician over last two years
- Green and colleagues use a single-server queueing model to show how panel size and level of service interact

Summary

- Healthcare is an extremely important and interesting area
- Healthcare organizations have many serious operational problems
- OR/OM modeling is needed to improve efficiency and reduce costs
- Developing useful models is difficult
  - Complex dynamics
  - Requires institutional and industry knowledge
  - Data may be hard to obtain