Team H.O.P.E.
Hospital Optimal Productivity Enterprise

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Introduction

- **Health care is a major concern**
  - Americans spent $1.7 trillion on health care in 2003
- **Hospitals one of the least efficient sectors**
- **Team HOPE**
  - Model emergency department (ED) at the University of Maryland Medical Center (UMMC)
  - Run simulations to find methods of improving patient throughput

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Small Projects

- Emergency Department Analysis
- TeleTracking System
- Discharge Lounges
- Intrahospital Transportation

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Research Questions

- How can ED efficiency and patient throughput be increased?
- What quantifiable factors are most effective in improving ED efficiency?
- What data will we need to create our model?
- What resources should we focus on in terms of management and operations in the ED?

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UMMC ED – Statistics Snapshot

- 34 ED beds
- Daily, ~3.6 patients pass through one bed
- Annually, 400-plus ambulance diversions
- Overall ED Length-of-Stay: 6 hours
  - ED Length-of-Stay for admitted patients: 10.3 hours
  - ED Length-of-Stay for patients treated in and discharged from the ED: 9.7 hours
- Overall, **15% of patients leave without being seen**

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ED Priority Numbers

- Scale of 1-4, with 1 being top priority (urgent, life-threatening) and 4 being lowest priority (patient came in to fill a prescription)
- Triage nurse determines by:
    - Chief complaint
    - Signs and symptoms
    - Past medical history
    - Urgency of vital signs
    - Personal instinct
- If available, priority 1 patients receive a bed immediately
- Generally, priority 2 and 3 are routed back to the waiting room

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Patient Flow in the UMMC ED

University of Maryland Medical Center
Emergency Department
Baltimore, MD

(C) Gemstone Team Hope

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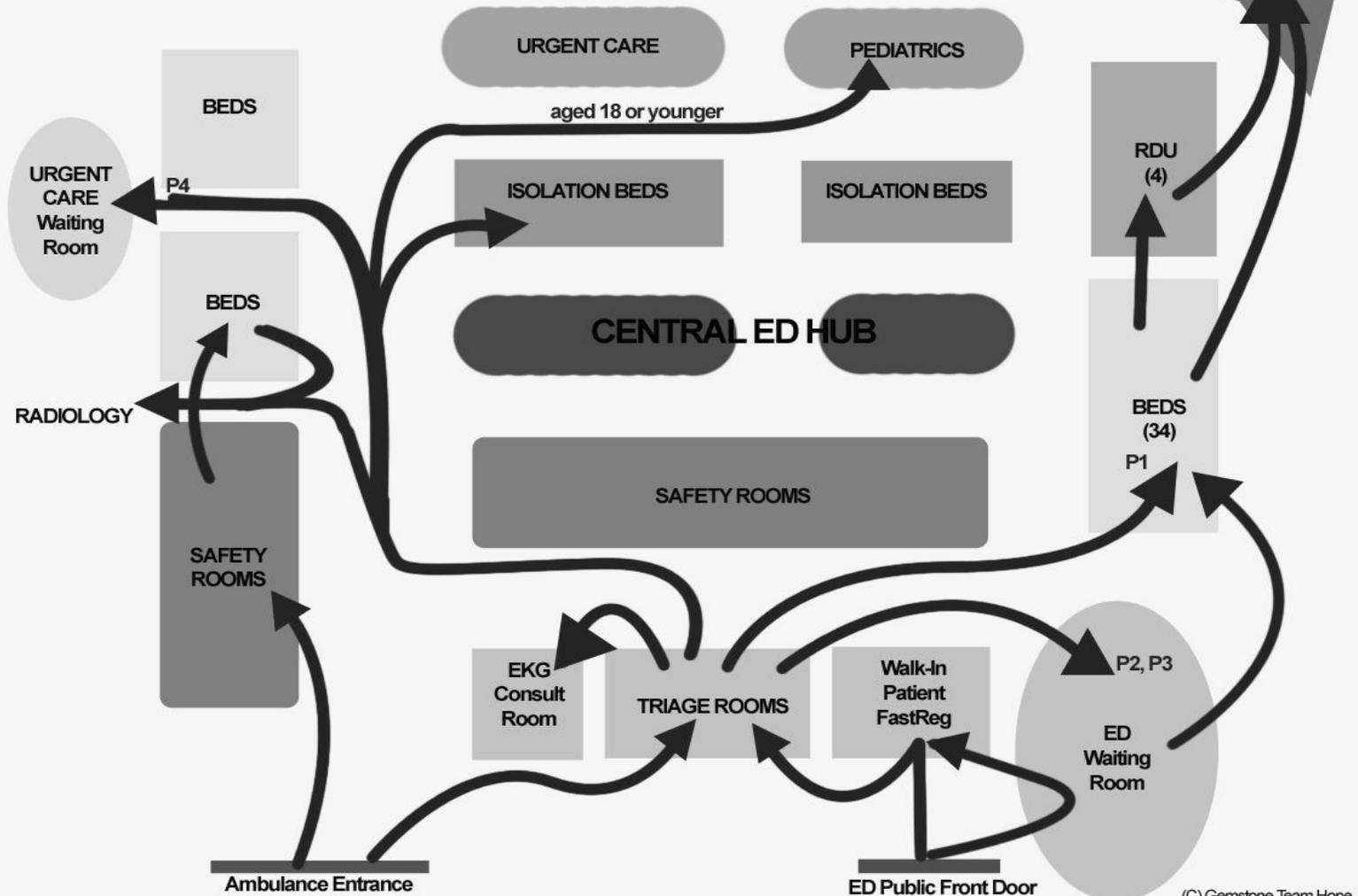
The Teaching System at UMMC

- "Teaching hospital"
- A single patient is seen by:
  - Third-year medical student
  - Intern
  - Resident
  - Attending doctor
- Each must perform their own initial assessments and report back to their supervisor
- Only the attending doctor may assign the disposition of the patient
- Redundancy = Bottleneck

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Toni Ruohonen in Jyväskylä vs. UMMC

- **Also used simulation to model an ED to improve throughput**
- **However, very different type of hospital**
  - Less than half the beds (200 vs. 670)
  - Regional, rural hospital
  - Adults and children treated by same ED
  - No teaching process in place
  - No ability to turn away patients
- **Methodologies will still be similar**

Ruohonen, 2007

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Modeling Overview

- Hospitals can use computer simulation to improve hospital efficiency
- We will create a computer model to simulate how the UMMC ED operates
- This model will help us discover and eliminate bottlenecks
- Steps we will take to create a computer model (see diagram to the right):
  Ruohonen, 2007

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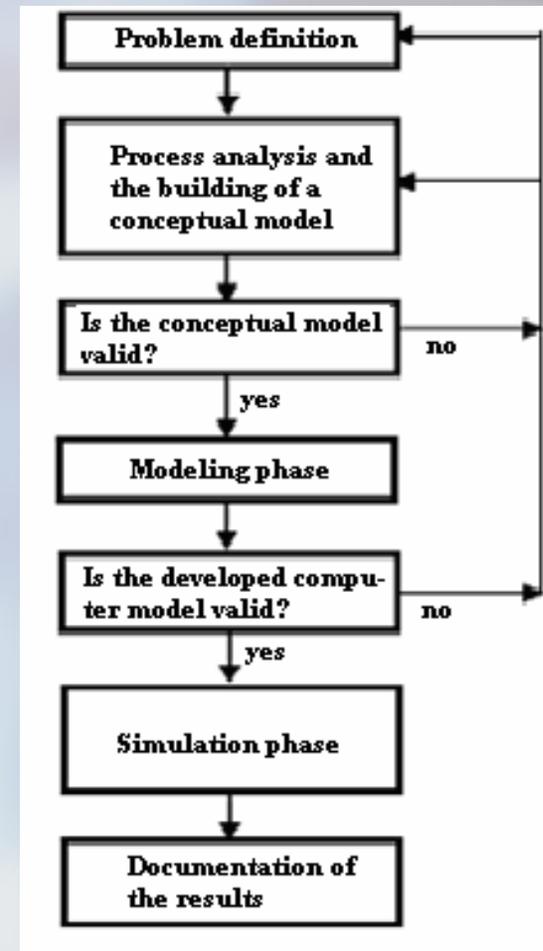
Patient Flow and Historical Data

- **Patient flow data**
  - Observe patient flow
  - Interview ED personnel

- **Historical Data**
  - Proportion of patients with each condition
  - Attributes of conditions – probability in need of testing and further hospitalization, average length of stay
  - Data spans time of day, day of week, week of year
  - Collected from hospital databases

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Group-Collected Data

- **Not all data in databases**
- **The remaining data needed must be collected manually**
  - Using a common form for data collection
  - Observing ED and collecting data
- **Much timing data must be collected**
  - Time spent in specific locations
  - Time spent doing specific procedures
  - Specific information about triage levels
  - Specific information about different types of health professionals

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Simulation Model Creation

- **Acquire simulation software (likely Arena)**
- **Define metric (likely patient throughput)**
- **Develop conceptual model**
- **Develop actual model**
- **Determine external validity of metric for whole system and subsystem**
  - Compare system-wide wait times with historical values
  - Check if results are reasonable with ED personnel

Experimental Design

- Use initial model to determine bottlenecks
- Develop solutions
  - Based on simulation model
  - Based on observations/intuition
  - Based on interviews with hospital personnel
  - Based on literature review
- Test solutions, compare to model of current operations as baseline
- Use ANOVA to determine significance of improvements

Problems

- **Assumptions**
  - Medical technology, patient patterns similar from year to year
  - Database data is reasonably accurate
- **Confounding variables**
  - Protocol changes
  - Data omissions and errors
- **Limitations**
  - Only access to UMMC data
  - No custom queries
  - Teaching hospital

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Contribution to Literature and Conclusion

- **Overcrowding is preventing hospitals from running at full capacity**
- **HOPE plans to improve efficiency through:**
  - Hospital records and first-hand observations
  - Identifying bottlenecks
  - Formulating models and simulation
- **Through simulation, HOPE plans to save UMMC money and increase patient satisfaction**

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Timeline
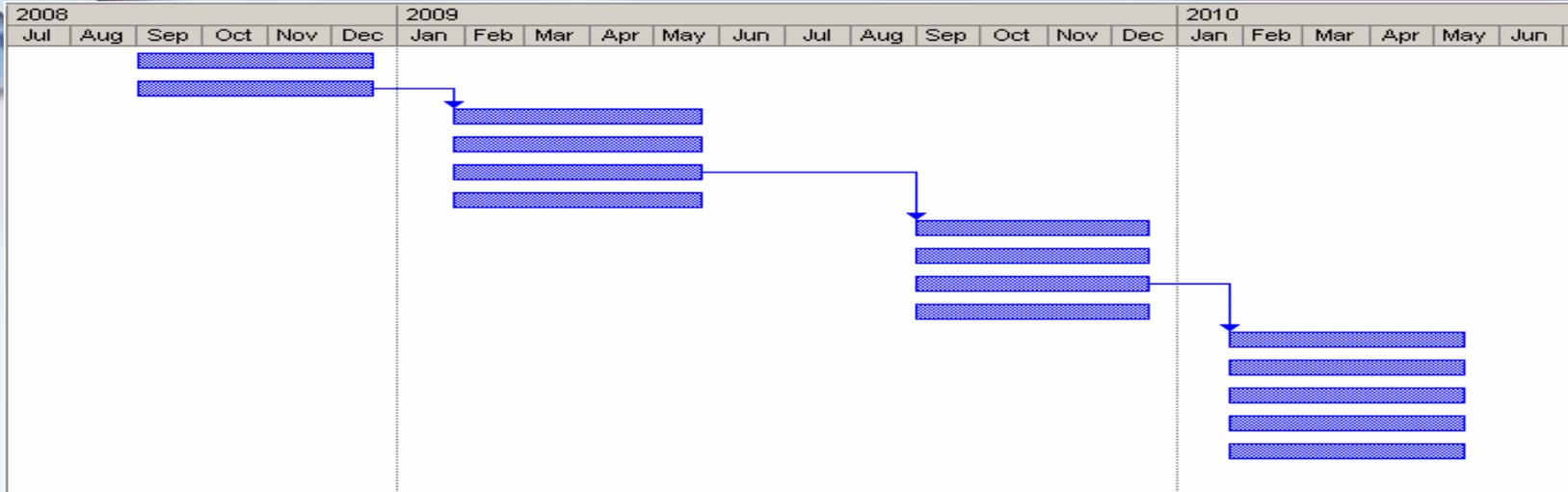
Task Name	Duration	Start	Finish	Predecessors
Collect data from UMMC for simulation	80 days	Mon 9/1/08	Fri 12/19/08	
Begin programming existing UMMC ED patient flow model	80 days	Mon 9/1/08	Fri 12/19/08	
Establish possible improvements to ED patient flow	85 days	Mon 1/26/09	Fri 5/22/09	2
Test effectiveness of changes in model	85 days	Mon 1/26/09	Fri 5/22/09	
Continue creating models with possible changes	85 days	Mon 1/26/09	Fri 5/22/09	
Present a research poster at Undergraduate Research Day	85 days	Mon 1/26/09	Fri 5/22/09	
Gather information from simulations and analyze effectiveness of all changes	80 days	Mon 8/31/09	Fri 12/18/09	5
Begin drawing conclusions from data analysis	80 days	Mon 8/31/09	Fri 12/18/09	
Start writing team thesis	80 days	Mon 8/31/09	Fri 12/18/09	
Attend Gemstone senior orientation	80 days	Mon 8/31/09	Fri 12/18/09	
Continue writing team thesis	80 days	Mon 1/25/10	Fri 5/14/10	9
Present and defend thesis to Gemstone staff and experts	80 days	Mon 1/25/10	Fri 5/14/10	
Make any necessary changes to thesis and present final work to UMMC	80 days	Mon 1/25/10	Fri 5/14/10	
Present finalized results to UMMC	80 days	Mon 1/25/10	Fri 5/14/10	
Graduate	80 days	Mon 1/25/10	Fri 5/14/10	

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The End
Any Questions?

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