CENTER FOR HEALTHCARE ENGINEERING & PATIENT SAFETY
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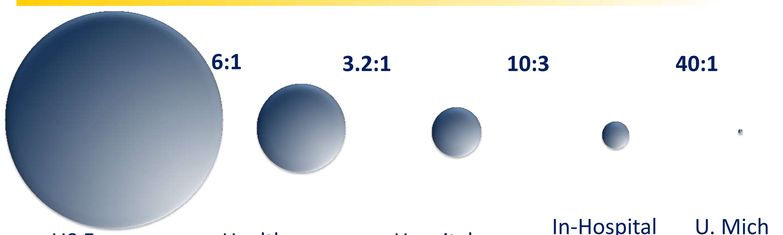
Optimizing Nurse Staffing with Absenteeism

Boying Liu[1], Kayse Lee Maass[1], Zhehui Wang[1], Rama Mwenesi[1,2], Mary Duck[1,2], Hannah Schapiro[1], and Mark S. Daskin[1]
[1]Department of Industrial and Operations Engineering, University of Michigan, [2]University of Michigan Health System

Problem Statement

Why Nurse Staffing



Rank	Cause	Deaths/year	Relative
1	Heart disease	652,000	665
2	Cancer	559,000	570
3	Stroke	144,000	147
4	Chronic Lower Respiratory Disease	131,000	134
5	Accidents	118,000	120
6	**Preventable Medical Errors**	**98,000**	**100**
7	Diabetes	75,000	77
8	Alzheimer's Disease	72,000	73

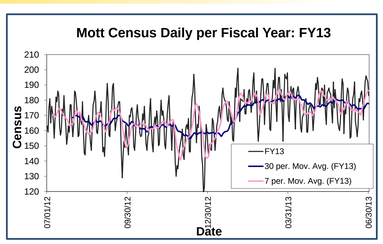
Effects of Nursing Levels

What is the proper staffing level?

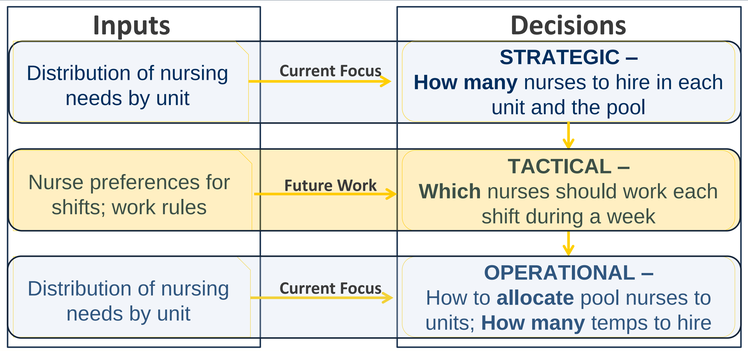
Key Issues

High Variability in Nursing Needs
- Day–to-day
- Among units

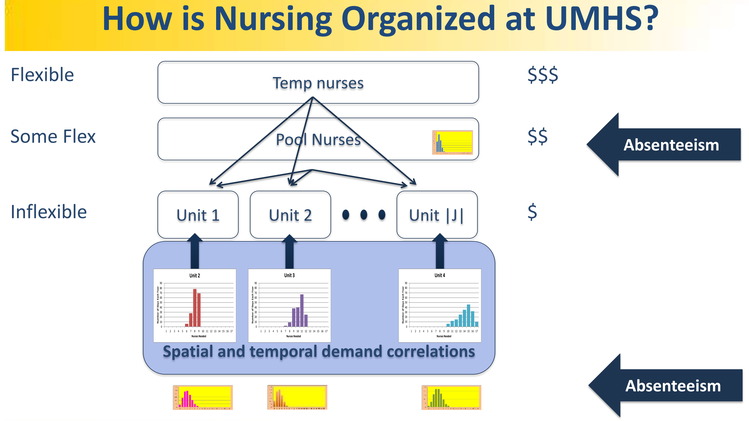
Unit and Pool Nurse Absenteeism
- Approximately 20% at UMHS



Solution Approach



How is Nursing Organized at UMHS?

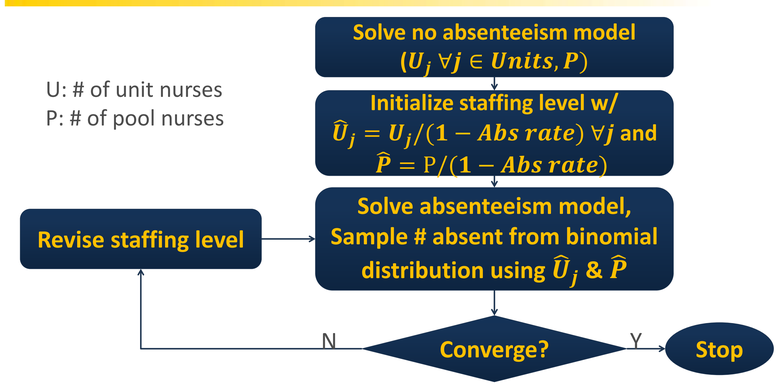


Model Description

Min Unit nurse cost + Pool nurse cost + Temp nurse cost – Benefit of extra nurses
s. t.
- Hire enough nurses to adequately cover patient demand in each unit each day
- All pool nurses are assigned each day

Solution Algorithm

U: # of unit nurses
P: # of pool nurses



Impact/Results

UMHS Data

- 5 pools of patient census data
  - date range July 2005 - June 2013
  - pool size from 3 to 13 units
- Nurse absenteeism: UMHS ~20%; Nationally ~7-10%

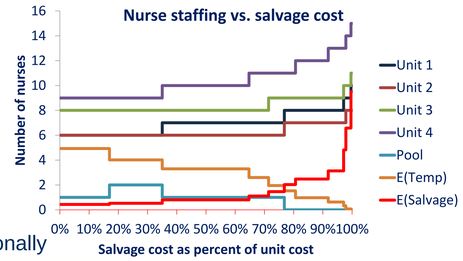
Data Analysis Results

- Day of week: Positive correlation
  -Monday census is closely correlated to Sunday census
- Monthly: Positive correlation among consecutive months
- Annual: Positive correlation between 07/08 and 10/11
- Unit-to-unit: Positive correlation among most units
- Distributional analysis
  -Data does not follow truncated Poisson distribution
  - Artificially simulating the process will be difficult due to lack of a distributional form and correlations

Optimal Staffing Level Without Absenteeism

2012 Historical Data
- 4 Pediatric Units
- Unit Cost: 1
- Pool Cost: 1.0667
- Temp Cost: 1.1555

Cost Savings compared to 80% staffing:
-3.6% savings
- ~$9 billion in savings nationally



No Absenteeism vs. Absenteeism

- Sample results: Jan 2012- June 2013
- Relative Costs: -Unit Nurse: 1 -Pool Nurse: 1.10
  -Temp Nurse: 1.19 -Salvage: 0.45

	Unit 1	Unit 2	Unit 3	Unit 4	Pool
No Absenteeism	7	6	8	10	1
20% Absenteeism	8	7	9	12	3

- 22% increase in total cost with absenteeism

Conclusions

- Optimal staffing must account for **variability in demand**, **differences in the cost** of various types of nurses, and nurse **absenteeism** rates
- Small percentage, but significant amount, of cost savings possible

Future Work

- Refine absenteeism rates, perhaps by day of week or time of year
- Account for seasonality of nursing demand, perhaps through another layer of nursing staff between unit and pool nurses
- Optimize assignment of units to pools
- *Work with UMHS nursing staff to implement findings*