Simulated Co-Location of Patients Admitted to an Inpatient Internal Medicine Teaching Unit

Potential Impacts on Efficiency and Physician-Nurse Collaboration

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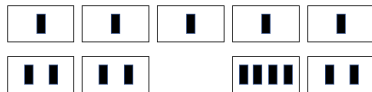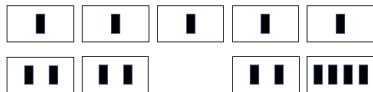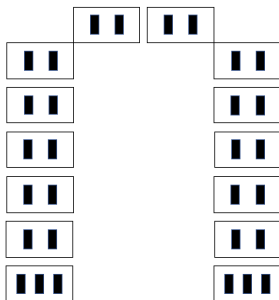Western University

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Overview

London Health Sciences Center
University Hospital Campus
Internal Medicine Inpatient Teaching Unit

Hospital Unit

Staffing Levels

	Three Physician Teams	**Nursing Staff**
Day Shift	1 Attending Physician 1-2 Senior Residents 2-4 Junior Residents	4 Patients per Nurse
Night Shift	1 Attending Physician 1 Senior Resident	6 Patients per Nurse

Definition of Problem

Goal 1

Reduce the number of physician team members that a nurse must interact with when reporting on their patients.

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Goal 2

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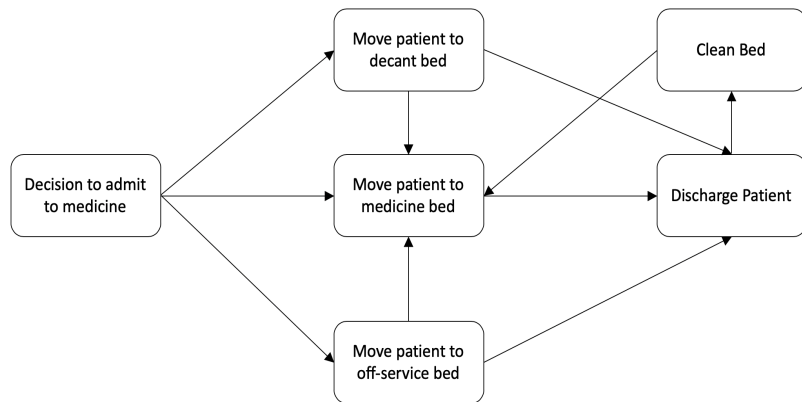
Goal 2

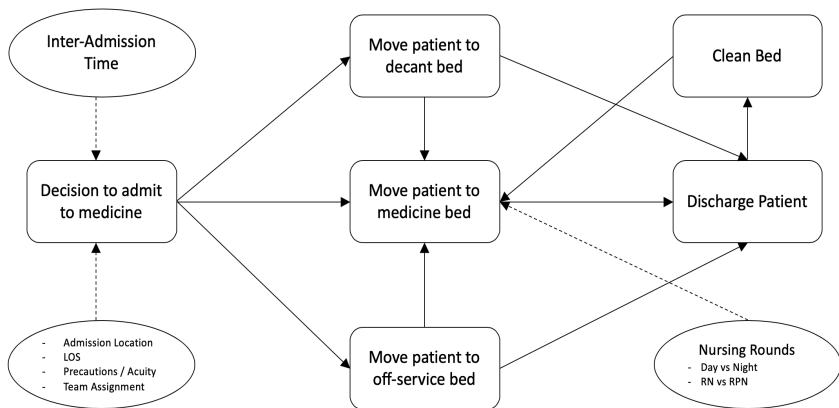Reduce variance in the number of patients between the three teams at daily census times.

Constraint

Avoid a significant impact on patients in the emergency department while maintaining current staffing levels.

Patient Flow

Modelling Patient Flow

Reference Simulation

Performance Metrics

Performance Metric	Observed Value	Simulation 95% CI
Waiting Time	6.4	$(6.7, 7.4)$
Admitted Patients Waiting	3.4	$(3.0, 3.3)$
Floor Utilization	94.8%	$(94.3\%, 95.2\%)$
Medicine Utilization	83.5%	$(82.1\%, 83.2\%)$

New Metrics

Definition (Patients Per Nurse)

$$\text{PPN} = \frac{\#\text{ Patients assigned to a team}}{\#\text{ Nurses assigned to those patients}}$$

- A measure of the number of nurses each physician team interacts with, normalized for the number of patients the team has.

- Optimally want to maximize this value for each team.

New Metrics

Patients Per Nurse (PPN)

Time of Observation	Simulation 95% CI
Start Day	$(1.49, 1.51)$
End Day	$(1.46, 1.48)$
Start Night	$(1.80, 1.82)$
End Night	$(1.84, 1.87)$

New Metrics

Definition (Team Census Variance)

$$TCV = \frac{\sum_{\text{Physician teams}}(\text{Team Census} - \text{Avg Census})^2}{3}$$

- A measure of how equally the patients are distributed among the teams.

- Optimally want to minimize this value.

New Metrics

Team Census Variance (TCV)

|	Observed Value	Simulation 95% CI
TCV	7.36	$(6.02, 6.71)$

Proposed Changes

Bed Assignment

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- Once a patient is assigned a bed, they must remain there for the duration of their stay.

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Team Assignment

- Primarily, patients receive the first available bed.
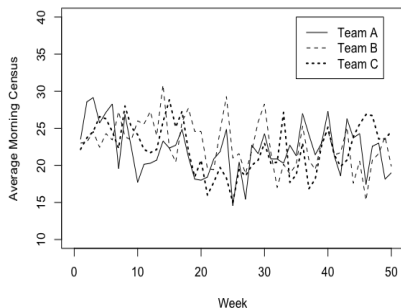- Secondarily, patients are assigned to the team with the least number of patients.
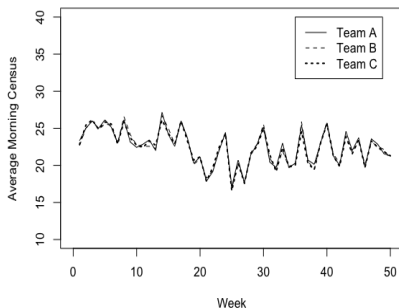
Bed Assignment
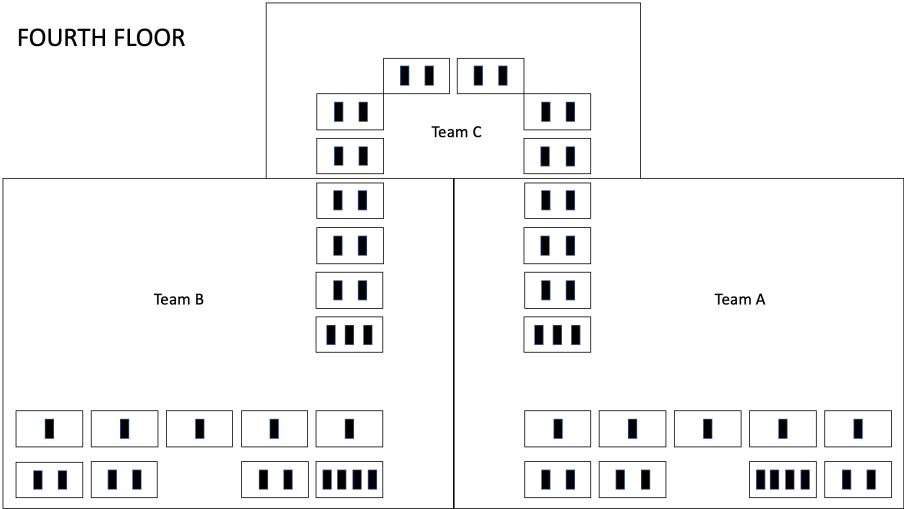
Team Assignment

Team Assignment

Results
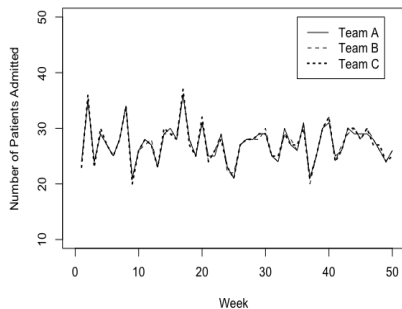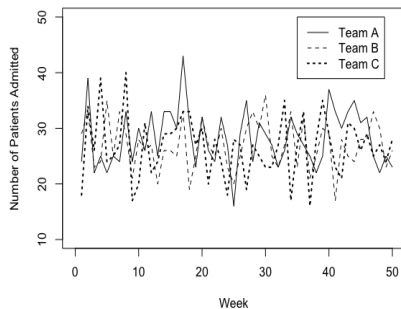
Performance Metrics

Performance Metric	Reference Simulation	Co-location 95% CI	P Value
Waiting Time	7.1	$(6.8, 7.4)$	> 0.05
Admitted Patients Waiting	3.1	$(3.0, 3.3)$	> 0.05
Floor Utilization	94.7%	$(94.3\%, 95.1\%)$	> 0.05
Medicine Utilization	82.7%	$(82.2\%, 83.1\%)$	> 0.05

Results

Patients Per Nurse (PPN)

		Start Day	End Day	Start Night	End Night
Reference Simulation		1.5	1.5	1.8	1.9
Co-location	Team A	3.2	3.1	4.4	4.7
	Team B	3.2	3.1	4.4	4.7
	Team C	3.3	3.1	3.9	4.1
Optimal PPN		3.4	3.4	5.1	5.1

Results

Team Census Variance (TCV)

	Reference Simulation	Co-location 95% CI
TCV	6.37	$(0.40, 0.43)$

Summary

Goal

- Maximize patients per nurse and minimize team census variance.

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Solution
- Assign a team to each bed so that team nurses are co-located.
- Assign patients to the team with the lowest census when possible.