Department of Industrial & Systems Engineering

Systems Design Project

Simulation of Operational Concepts for Outpatient Listing Facility

Team: Bain Zhen Jian Addison, Leonard Kenneth Clerigo Barro, Phua Peck Kun, Rishabh Srivastava, Soon Jia Lu
Supervisors: Associate Professor Chew Ek Peng, Assistant Professor Huang Boray
Industrial Liasons: Geoffrey Gui[1], Matthew Han[1], Chia Kuok Wei[1], Jarojah S Narayanasamy[2]
[1] Service Operations, [2] Specialist Outpatient Clinic Admin

Problem & Objective

Current Situation

The Specialist Outpatient Clinics (SOCs) at SGH currently have individual listing facilities and face highly uneven workloads. This contributes to sub-optimal allocation of resources.

Overview of the Listing Process

Patient finishes consultation with doctor → Patient undergoes listing for surgery → Patient exits the clinic

Objective

To design a centralized listing facility that reduces resource deployment without increasing patients' waiting time.

Methodology

System Observation

- Observed system during operating hours
- Identified process characteristics
- Interviewed listing nurses and other stakeholders

Data Analysis

- Engaged key stakeholders in collection of data
- Performed statistical analysis on data collected

Simulation Modeling

- Validated assumptions by interviewing stakeholders
- Simulated design alternatives using the ARENA software

System Design

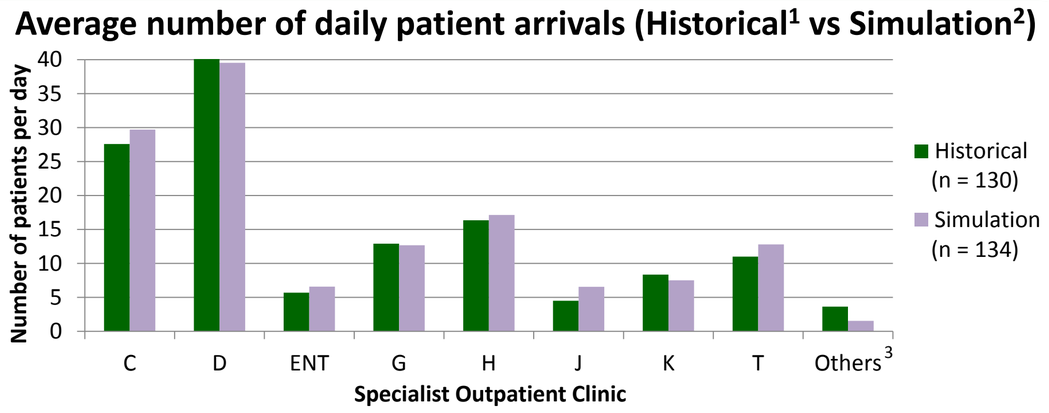
- Considered system level impacts of design alternatives to frame recommendations
- Formulated action plan for implementation

Findings & Analysis

Key Findings

- Average of 130 daily patient listings per day[1]
- 23 listing stations were utilized
- Average waiting time for patients is 19.2 minutes.
- 25% of clinics (SOC C, D and H) account for 65% of the workload.
- Uneven workload distribution amongst clinics.
- Nurses perform majority of the listing functions instead of patient service associates (PSAs).

Average number of daily patient arrivals (Historical[1] vs Simulation[2])



[1] Using Nov 2011 to Oct 2012 historical data (daily average)
[2] Based on 50 independent replications from simulation
[3] Includes Clinic A, B, L & M

Simulation of Operational Concepts

Operational Concepts (OC) Considered

OC1: Centralized Facility at the Gastro-Intestinal Centre (GIC)
OC2: Centralized Facility at a possible new location in Level 1 (L1)
OC3: Clustered Facilities at GIC and L1

Selection of Best Operational Concept

The number of servers in each design was varied and the resulting performance was analyzed to determine the best design configuration. The performance of some of these variations, based on 50 simulation replications, is compared on the right.

Comparison of Selected Operational Concept Configurations

Operational Concept	Current System	OC1		OC2		OC3		
Number of Listing Stations	23	9#	10^	9	10	6 (GIC) + 3 (L1)	6 (GIC) + 4 (L1)	7 (GIC) + 3 (L1)
Average Waiting Time (mins)	19.2	9.0	4.3	7.9	4.8	13.8	7.4	11.0
95th Percentile Waiting Time (mins)	71.0	31.5	19.0	28.2	19.4	56.2	30.3	53.4
Ease of implementation*	N/A	1	2	3		3		

*** 1 = most easy to implement, 3 = least easy to implement.**
 # Optimal Short-Term Choice, ^ Optimal Long-Term Choice

Recommendations

Core Recommendations

Short-Term: In view of its expected benefits and ease of implementation, **a switch from the current listing system to a centralized facility with 9 staff at GIC is recommended**. GIC already has a site that can be readily converted to a centralized listing facility with up to 9 listing stations. As such, the switch can be done without excessive renovations.

Long-Term: In the long-term, **it is recommended that all listing functions are right sited to PSAs**. Moreover, If patient volume increases in the long run, the development of an additional listing room at GIC is recommended in order to maintain service quality.

Expected Short-Term Benefits

1. 61% reduction in listing stations (reduction of 14 stations)
2. 53% reduction in average waiting time (reduction of 10 minutes)
3. 56% reduction in 95th percentile waiting time (reduction of 40 minutes)
4. 98% patients expected to experience shorter waiting times

Expected Limitations

1. Additional walking distance of up to 200 meters from the furthest SOC
2. 2% of patients (from Clinics A, B and L) may experience increased waiting time since they currently visit clinics with low workloads and shorter waiting times