Optimising Sengkang General Hospital Emergency Department Doctor Resource using Simulation



Singapore Healthcare Management 2019

Saw Xun Yi Angus, SHHQ, Office for Insights & Analytics Ivan Tan En Howe, SHHQ, Office for Insights & Analytics Phoebe Wu, SHHQ, Office for Insights & Analytics Dr Lee Chengjie, SKH, Department of Emergency Medicine Dr Annitha D/O Annathurai, SKH, Department of Emergency Medicine Sherlyn Teo, SKH, Department of Emergency Medicine William Ng Wei Liang, SKH, Quality and Risk Management Office

Introduction

The Emergency Department (ED) in Sengkang General Hospital (SKH) provides emergency care to walk-in and ambulance patients. A key challenges is to manage high volumes of patients with limited manpower. This may result in long wait times and delays in providing timely care. The project aims to use **3D computer simulation** software to model the current state in the ED and simulate possible scenarios to recommend manpower resources required for improvements in patient experience.

Methodology

1. Understanding the current state of the ED

Results

1. P3 patient track

The initial phase of the project was to understand the current state of the ED. We mapped out the entire patient journey in the ED, detailing each movement, process and decision point. This was done for both walk-in and ambulance patients requiring different acuity of care. *End consult – departure*



The arrival volume for walk-in and ambulance patients was also analyzed from the period of October 2018 to March 2019. Actual hourly patient arrivals in this period showed a daily bimodal distribution for walk-in patients at **10AM** and **8PM**

Average patient arrival (SKH) (1/10/2018 to 31/3/2019)



2. Modelling ED patients' journey

FlexSim Healthcare is a 3D simulation modelling software used to visualize and analyse patient based processes in healthcare. It allows the risk-free testing of various "what if" scenarios. A floor plan of the ED was used to build a model of the ED which includes key areas that patients will pass through from registration to discharge.

Increasing by one more doctor for a shift

Average wait time to consult is reduced by 86%. However, with higher throughput, there is an increase of 47.5% in the average end consult to departure duration. Thus, the impact on downstream processes needs to be considered when increasing manpower upstream.

2. P2 walk-in patient track

Adding a straddle shift 1700 to 0100

In the ED, P3 walk-in patients with minor emergencies are seen in P3 Consult while P2 walk-in patients requiring expedited care are seen in P2 Northpod.

Actual patient arrival data from October 2018 to March 2019 was fed into the model. Estimated distributions of key process durations such as consultation and registration were provided by ED doctors and input into the model. Physical space capacity, staffing numbers and shift schedules were also accounted for.

3. Scenario simulation of possible resource reconfigurations

After the model development process, the model was used to simulate the following different scenarios to quantify improvements in wait time to consult for the patient journey. We focused our improvements at the P3 patient track and the P2 walk-in **patient track** as they had the longest wait time to consult, which is a key factor of overall patient experience. <u>P3 patient track: Increasing by one doctor</u>

The model was run for a week from Monday 0000 hours to Sunday 2359 hours and the wait time to consult was compared with the current state in the ED. The wait time to consult is defined in the model as the duration from end triage or end registration to start of consult by a doctor.

Adding one		Adding one		Adding one
more doctor		more doctor		more doctor to
to morning	OR	to evening	OR	night shift

Firstly, having a straddle shift improves the wait time to consult for P2 walk-in patients at night by 64%. Secondly, enabling workload sharing in the evening with P3 consult helps to improve the wait time to consult for P3 by 70%. However, workload sharing with P3 causes wait times for P2 walk-in to increase, as P2 Northpod doctors may be attending to P3 patients.

P2 walk-in track: Enabling workload sharing with					
<u>P3 in the evening</u>					
P2 Northpod		P3 Consult			
1500 to 2300	22	1500 to 2300			
and the second sec					

P2 walk-in track: Adding a straddle shift

Workload sharing with P3 refers to having doctors from P2 Northpod assist doctors in P3 Consult when available. However, attending to P2 walk-in patients still takes higher priority. Scenarios like **increasing staffing** by one doctor per shift and adding a **straddle shift** timing to cover the evening patient arrival peak are also simulated.

Summary

1. Implementation of findings

The model has shown that having a straddle shift provides the additional bandwidth needed for workload sharing with P3 in the evening. This improves wait time to consult for P3 and P2 walk-in patients in the evening. While the project was ongoing, the ED concurrently implemented the straddle shift timing on the ground. The real-world improvements in wait time was anecdotally consistent with the simulation results.

2. Future applications

The model could be refreshed with new data and be extended to other institutions' EDs. The model can be used to simulate how changes to numbers and layouts of physical resources (beds, Xray machines) can impact process timings. Cost benefit analysis can be done to make informed decisions on resource allocations.