Development of an Automated Nurse Rostering System for the Emergency Department in the Singapore General Hospital

Introduction

The dynamic working environment in the emergency department poses many challenges to creating rosters, due to the wide range of rules and requirements, such as skill and gender mixes. These difficulties hamper the current manual rostering process, which requires more than 100 nurses to be scheduled within a 2 week period. Hence, the objective of this project is to develop an efficient system in order to reduce the time taken and effort needed to produce monthly rosters for nurses in the emergency department.

Methodology

Interviews with nurse clinicians and analysis of patient arrival data were conducted to determine the rostering operational requirements.

Mathematical model with 4 key performance metrics was developed in order to reflect these objectives and measure roster quality and performance.

Implementation

System Development and Usage

• Automated rostering system based on a mathematical optimization model
• Flexible response to changes in patient arrival patterns and staff requirements
• Based on Microsoft Excel and AIMMS (optimization software)

1. Input
User enters in three initial inputs for the model:
1. Expected daily patient demand
2. Nurse skill levels
3. Applied leaves and special cases

2. Optimization
Shifts are then assigned through AIMMS in order to achieve the desired objectives while adhering to the strict scheduling requirements

3. Output
Raw solver outputs from AIMMS are translated into rosters for deployment in Excel.

Results

The rosters created through the automated system were compared with manually created rosters for similar time periods based on key performance indicators used in the mathematical model.

Key Results:
1. Efficient allocation of manpower in response to patient demand
2. More equitable distribution of undesirable shifts
3. High number of approved requests
4. Reduction of long working stretches by distributing non-working days

Conclusion

The automated rostering framework reduces the time and effort needed to create monthly rosters, improving manpower allocation in response to patient demand and maximizing staff satisfaction through more equitable shift allocations. It also has the potential for future modifications and extensions to be made in lieu of policy changes, demonstrating its flexibility in use for operations.