Workload Leveling and Resource Maximization in the Antenatal Diagnostic Centre

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1. Introduction

Antenatal Diagnostic Centre (ADC), under the Division of Maternal-Fetal Medicine, Dept of Obstetrics & Gynaecology, provides a comprehensive range of services for screening, diagnosis, counseling and management of fetal abnormalities during pregnancy.

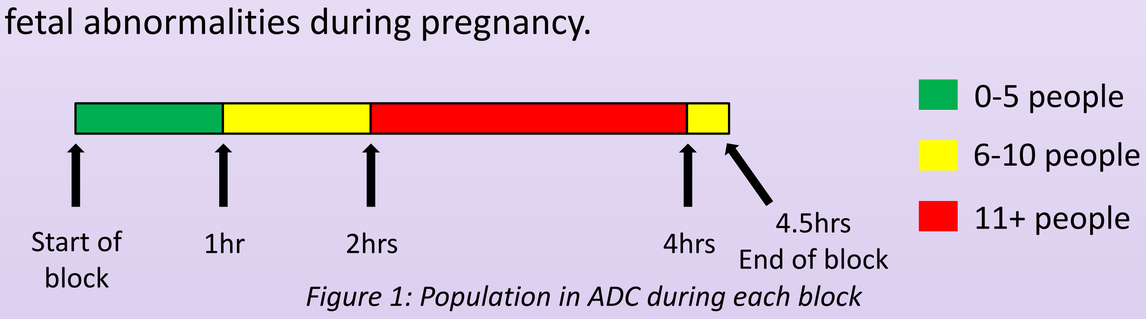

Figure 1: Population in ADC during each block

Each day in the ADC can be split into two blocks. The figure above shows the three critical periods in the ADC where the population in the ADC crosses certain thresholds. During the green period, waiting times are relatively low. 1 hour after the block starts, the ADC starts filling up. However 2 hours after the start of the block, the ADC gets extremely crowded. Only 0.5 hours before the end of the block does the average population in the ADC drop again.

2. Problem Description

From our data analyses, our group has identified long waiting time for service as the main cause of bottlenecks in the ADC. Waiting time for service is defined as

•The difference between a patient's appointment time and the time she enters a sonography room if she arrives *before* her scheduled appointment

Or

•The time difference between her arrival time and the time she enters a sonography room if she arrives at the ADC *after* her scheduled appointment.

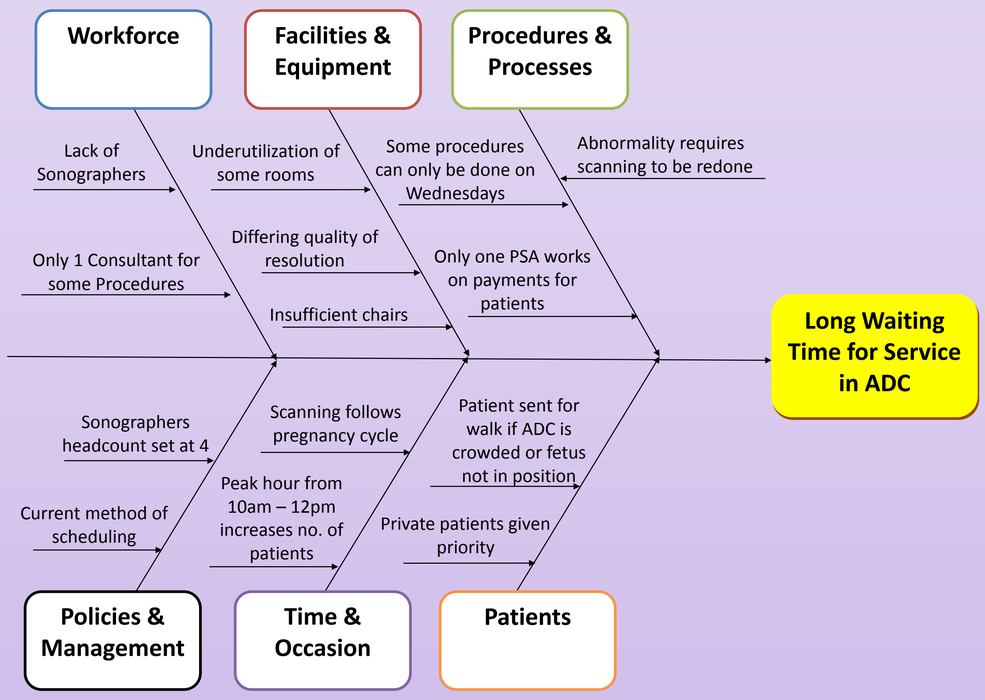

Figure 2: Fishbone diagram

Furthermore, it was discovered that the current method of scheduling is the critical cause of the congestion. This results in only around 48% of patients waiting less than 1 hour for service.

3. Objective

To devise a method of scheduling such that at least 70% of patients wait less than 1 hour for service.

4. Methodologies/Approaches

In order to calculate the optimum interval between patient arrivals, our group collected and analyzed data on waiting times for service, the lateness of patients, service times and waiting times for payment in order to create a simulation model that would take all these factors into account.

The simulation model allows us to change only the interarrival time of patients to maximize the proportion of patients waiting less than 1 hour. All other factors are system dependent. Thus they differ from patient to patient and cannot be predetermined.

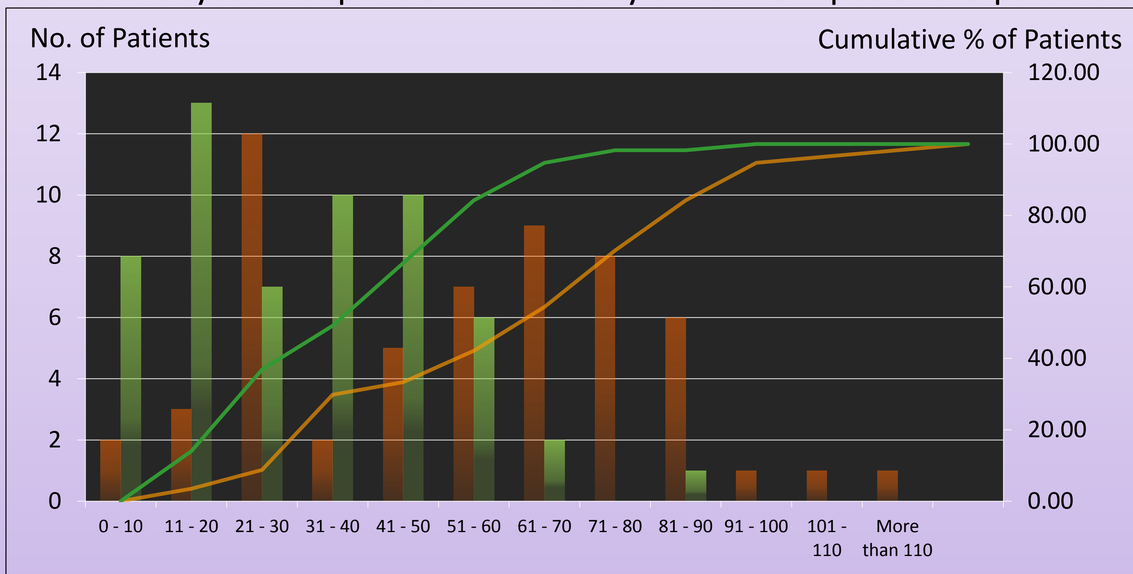

Figure 3: Waiting time of patients

- The orange bar chart shows the number of patients whose waiting times fall within that particular interval
- The orange line graph shows the cumulative percentage of patients who have waited for service up to the interval stated on the horizontal axis
- The green bar chart and line graph shows the waiting time for patients using the blocking method

Method Proposed	Leveling	Matching	Blocking
Average Waiting Time for Service	60 min	55 min	**42 min**
% of Patients Waiting Less Than 1 Hour for Service	53.44%	58.60%	**74.06%**

Figure 5: Table displaying performance measures of solutions

Therefore our group recommends using the *Blocking Scheduling Method,* because of the highest percentage of the patients waiting less than 1 hour for service and the least average waiting time.

Method Proposed	Leveling	Matching	Blocking
Methodology	Schedule patients to come in equal time intervals throughout ADC's operating hours	Schedule patients' arrivals by matching them with the service times of the scans/procedures	Schedule patients to come in equal time intervals between 8.30am and 12pm, and between 1pm and 5.30pm
Rationale	To ensure that effects of congestions during peak hours are spread out to the non-peak hours	Allow patients to arrive preferably just a short moment before a current patient finishes her scan/procedure	To ensure that effects of congestions during peak hours are spread out within each block

Figure 4: Table identifying possible solutions

5. Recommendations