

## INTRODUCTION

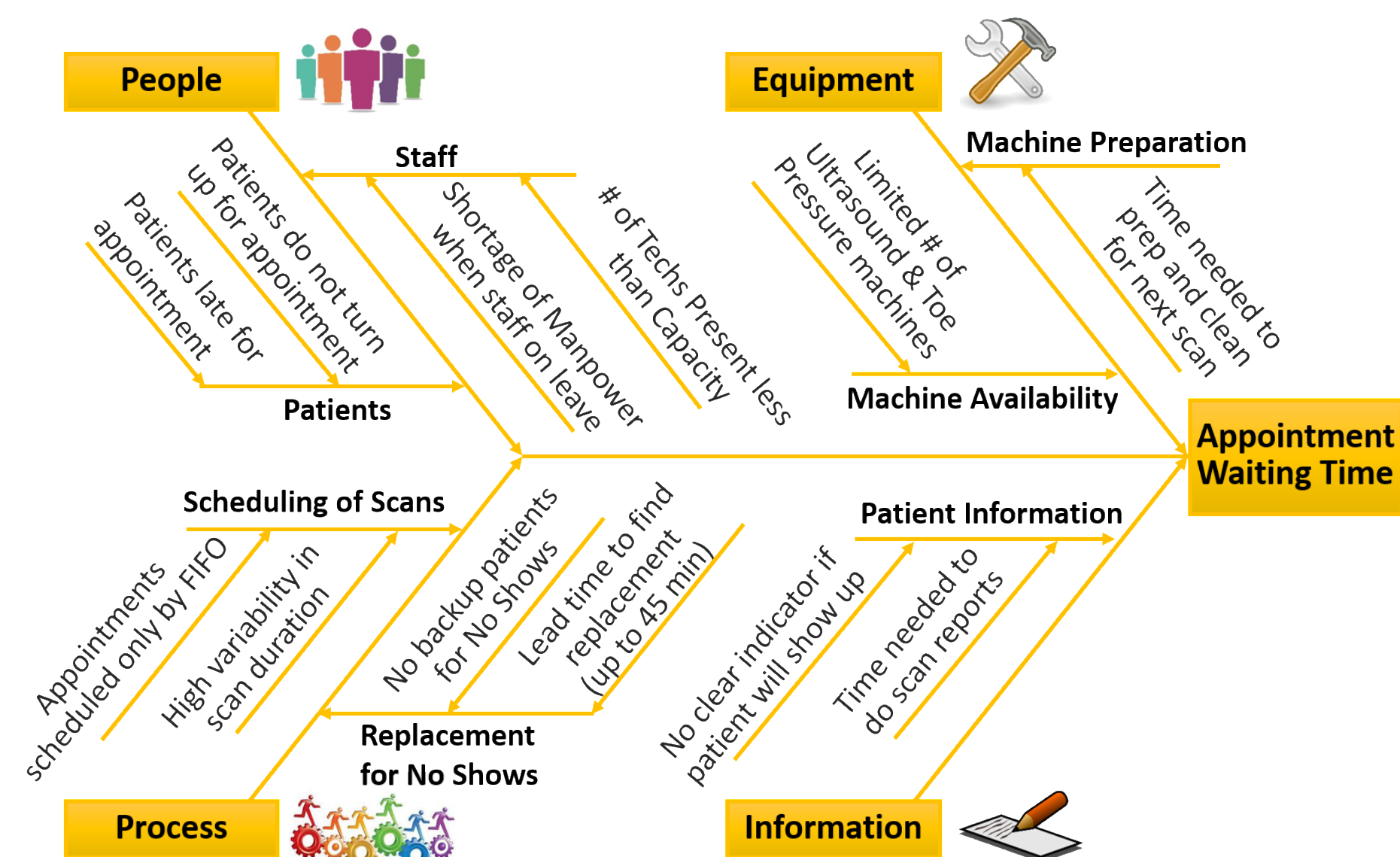
The National University Hospital (NUH) Diagnostic Vascular Lab (DVL) provides vascular ultrasound and peripheral vascular screening to both inpatients and outpatients. As it performs scans for different specialties, it receives a large variety of orders and completes an average of 540 scans every month. Due to the unpredictable nature of each scan, the waiting time between order and scheduled dates for outpatients is approximately 3-6 months. There is a need to monitor and understand the processes at the lab and draw any insights as to how to best optimize appointment scheduling at the lab.

## OBJECTIVES

1. Decrease average idle time in between scans through more effective ways of scheduling
2. Reduce waiting time between the date the scan is ordered and the date the scan is scheduled for outpatients

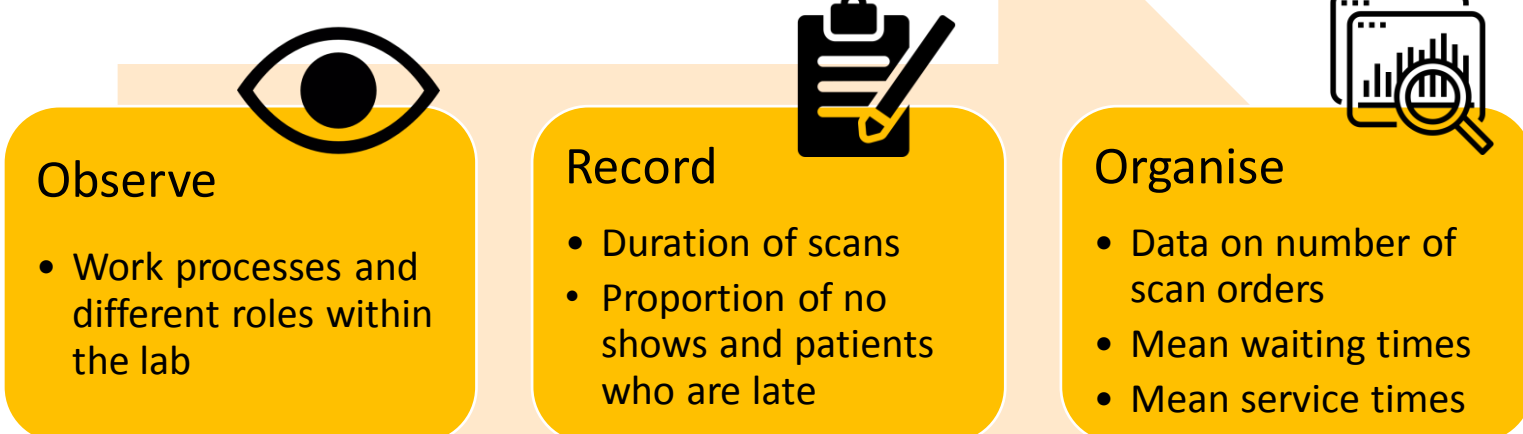
**Key Performance Measure: Average Waiting Time**

## CHALLENGES



## SIMULATION

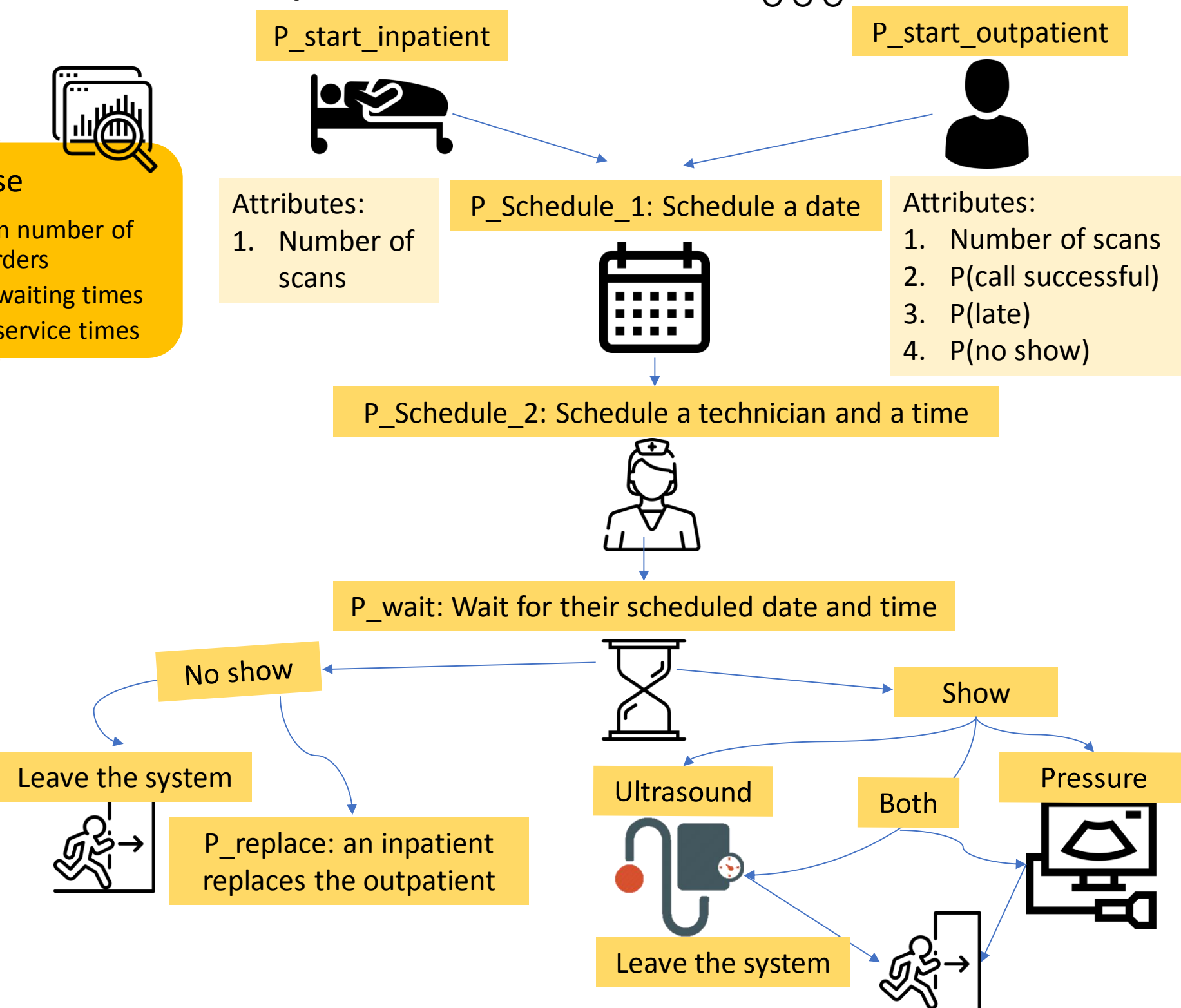
### 1) DATA COLLECTION



### 2) INPUT DATA

1. Interarrival times of inpatient and outpatient scan orders
2. Service time of technicians based on the number of scans (1, 2 and 3 or more)
3. Probability of outpatients answering call to confirm their appointment (1 day in advance)
4. Probability of outpatients not turning up for their appointment
5. Resources in the lab to perform all the scans

### 3) OVERALL FLOW



### 4) MODEL ASSUMPTIONS

- Interarrival times for outpatients and inpatients scan orders remain unchanged throughout the simulation
- All inpatients are suitable candidates for last minute replacement when outpatients do not turn up
- No-show outpatients are not redirected back into the system
- Lab technicians work 7 hours a day for 5 days
- Lab technicians in charge of inpatients do not conduct scans for outpatients

### 5) MODEL VALIDATION

- Simulation Base Model
- Automod Simulation
  - A period of 4 years

Key Performance Measures:

1. Inpatient Waiting Time
  2. Outpatient Waiting Time
- The output parameters collected from the DVL, is within a 95% confidence interval of the output parameters of the model

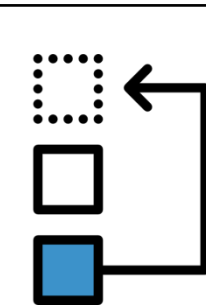
## SENSITIVITY ANALYSIS AND RECOMMENDATIONS

### Solution 1:

- Sort patients by time required for scan(s) then do scheduling

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- Patients requiring 1 or 2 scans are scheduled in the morning



Rationales

- The number of scan hours allocated in the morning is more
- Higher turnaround rate
- Minimizes accumulated delay due to variability
- Limit patients with 3 or more types of scans

### Solution 2:

- Call patients 7 days prior to the appointment
- Secondary Contact



- Consider overbooking when P(no show) given that the call was unsuccessful increases



Rationales

- When unsuccessful calls become a better indicator for no shows, overbooking of inpatients should be considered
- Reduce time taken to source and transport inpatient to the lab

### Solution 3:

- Demand of orders should be monitored closely to spot trends and be used for staff forecasting



Rationales

- Utilization of machines increased with an additional technician
- Number of lab techs is an extremely sensitive input parameter
- Schedule staff leaves during non-peak periods