Reducing Patient Wait Time Using Radio-Frequency Identification (RFID) Technology

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Background
- Glaucoma is the second leading cause of blindness in the U.S. and affects over 3 million people in the U.S.
- Physicians feel there is not enough time to educate patients. Many patients feel that they spend too much time in the waiting room and not enough time with their physician.
- Several factors such as limited staff and exam room availability can create schedule bottlenecks in which wait times dramatically increase.

Purpose
The purpose of our project is to reduce patient wait times through use of a simulation to optimize clinic flow. To accomplish this, we use passive RFID data based time-motion studies to inform clinical operations and scheduling.

Methods
- Patients and providers wear RFID tags while in clinic
- Tags ping RFID readers twice per second
- Wait time measured as time patients are not with providers
- Data is collected and stored in a secure database that is directly accessible by the project team
- The following data points were analyzed from the raw data
  - Patient visit durations
  - Patient process times
  - Patient wait times
- The data were collected between 1/5/18-7/3/18
- The simulation was designed with the following configurations:
  - Clinic open time: 7:30am - 5:00pm
  - Number of simulations: 20,000
  - Python Version: 3.6.5
  - SimPy: 3.0.10

Results: RFID Data

Patient Visit Duration and Wait Time Data

Figure 3. Average Visit Duration and Wait Times for All Patient Types

Over 2,000 patient participants were studied. Patients spend a large percentage of their visit waiting for providers (New 38.2%, Return 57.5%, Visual Field (VF) 48.6%, and Post-Op 48.9%).

Results: Simulation

Simulation Inputs

- Type of Provider
  - Check-in Clerks*: 2
  - Technicians: 5
  - Visual Field MAs: 3
  - Photographers: 4
  - Residents: 1
  - Fellows: 0
  - Physicians: 3
  - Check-out Clerks*: 4

* Resource shared with Retina clinic

Type of Patient

- New Patient: 8
- Return Patient: 30
- Post-Op: 11
- Visual Field: 27
- Laser: 3
- Urgent: 1
- Total: 80

Queuing Visualizations to Identify Bottlenecks

Figure 4. Patients Waiting for Technician

Figure 5. Patients Waiting for Visual Field Test

- Many bottlenecks occur with patients waiting for technicians
- One possible solution may be to hire additional technicians in the clinic to decrease these wait times

Results: Technician Simulation

Simulated Effects of Adding Technicians

Figure 7. Simulated Patient Wait Times with Additional Technicians

Hiring additional technicians does address the identified bottleneck, however, wait times for VF testing and physicians subsequently increase according to our simulation.

Conclusions

- Low cost and passivity of RFID system allows collection of vast amounts of data to inform clinical operations
- Tracking patient wait time is an important metric to assess the value to the patient
- The deployment of RFID technology serves as the analytic backbone of Lean Clinical Improvements in this pilot study

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